MAHDI FALLAH

Cancer Incidence in Five Provinces of Iran

Ardebil, Gilan, Mazandaran, Golestan and Kerman, 1996 – 2000

■

ACADEMIC DISSERTATION
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Abbreviations

AIDS	*Acquired immunodeficiency syndrome*
ARASR	*Adjusted relative age-standardized rate*
ASR	*Age-standardized rate*
CI	*Confidence interval*
CVD	*Cardiovascular diseases*
DDRC	*Digestive Disease Research Center*
DNA	*Deoxyribonucleic acid*
ESCC	*Esophageal Squamous Cell Carcinoma*
GDP	*Gross Domestic Product*
GI	*Gastrointestinal*
HBV	*Hepatitis B virus*
HIV	*Human immunodeficiency virus*
HPV	*Human papilloma virus*
IARC	*International Agency for Research on Cancer*
ICD-O	*International Classification of Diseases for Oncology*
IPHR	*Institute of Public Health Research of Tehran University*
MV	*Microscopic verification*
NH	*Non-Hodgkin*
NK	*Natural killer*
NOS	*Not otherwise specified*
PSA	*Prostate-specific antigen*
RASR	*Relative age-standardized ratio*
SEER	*Surveillance Epidemiology and End Results*
SIR	*Standardized incidence ratio*
WHO	*World Health Organization*

Abstract

Background

Cancer is the most common non-injury cause of death after cardiovascular diseases in Iran. Estimation of the burden of cancer in terms of incidence, mortality, and prevalence is the first step to plan control measures in every country but for almost 40 years there were no population-based cancer statistics in Iran to reveal cancer burden. This study is designed to ascertain the incidence of cancers in Iran, and develop and test a new method to adjust for ascertainment bias in the evaluation of cancer registry data.

Material and Methods

A retrospective survey in five provinces of Iran (Ardebil, Gilan, Mazandaran and Golestan in the north, and Kerman in the south) carried out for five years, 1996–2000. These provinces composed 15.7% of about 60 million population of Iran in 1996. Available medical records of cancer patients in public/private hospitals and diagnostic/treatment facilities, and death certificates of these five provinces were compiled, computerized and duplicate reports were eliminated. Eighty four percent of cases were microscopically verified and *death certificate only* (DCO) cases constituted 0.1% of cases.

Relative age-standardized ratio (RASR) was calculated by ASR of each cancer divided by ASR of leukemia. Adjusted relative age-standardized rate (ARASR with same unit as ASR) is calculated by multiplying the RASR for a specific cancer in a particular year by the sum of ASRs of that cancer over the years for which a trend is being determined and then dividing result by the sum of RASRs of the cancer for those years. Two likely assumptions are behind use of ARASR, first, constant ASR of leukemia over time, second, if under/over-registration occurs, it happens to all cancers in the same extent (random under/over-reporting).

Results

During the five years of study, there were 28,022 new cancer cases (57% men; 42% women; 1% unknown sex). The mean age at diagnosis was 55 (median age 60). In terms of age-standardized rate (ASR per 10^5), the most common cancers in men were stomach (22.5), esophagus (12.1), bladder (7.5), lung (6.5), colon/rectum (6.2) and prostate (5.6). The cumulative rate for 0–69 years of life in men was 7.8%. The leading female cancers were breast (13.3), stomach (9.3), esophagus (8.9), colon/rectum (6.0), leukemia (2.4) and cervical cancer (2.3). The cumulative rate for 0–69 years of life in women was 6.4%. In terms of incidence among these five provinces, stomach cancer had the highest rate in Ardebil province in both sexes. Highest rate of esophageal cancer was in Golestan in both sexes. Breast cancer was highest among Kermanian women. Highest rate of bladder and prostate cancer was recorded for Gilanian men whereas Gilanian women had highest rate of colorectal cancer. Highest rate of lung cancer found among Mazandaranian men. Kermanian men had the highest rate of skin or hematological neoplasms such as leukemia or lymphoma. It is predicted that the annual number of new cases in year 2010 in Iran compared to 1996 will increase 65% (women 95%; men 46%) at least to 53,000 persons.

A new method was developed and tested on some complete and incomplete cancer registry data to adjust for ascertainment bias in cancer registry data. In registries with incomplete reporting, ARASR was a better estimate for time trend analysis. ARASRs in different countries or different times were comparable since they were already standardized for age structure. In addition, comparison between time trend of ASR and ARASR could be used to evaluate completeness of registration.

Conclusion

Generally the incidence of cancer in Iran was among lowest in the world. Cervical cancer was lower than even low risk countries such as China, Kuwait or Spain. Compared to 30 years ago, the incidence of esophageal cancer declined to approximately two thirds of its previous level in both sexes. However, the incidence of all other cancers increased dramatically up to 120%. Although this increase was unrealistically high, most likely because of under-registration of other malignancies than esophagus 30 years ago, the real change seems to be in the same direction but with slower slope.

The 65% predicted increase in the number of new cases by year 2010 is a huge burden for the health care system because by adding the number of old cases to these cases, the number of prevalent cancer patients will be substantially higher in 2010, especially in women.

The estimates by GLOBOCAN2002 and the results of this study were highly concordant because they shared the majority of their data sources except for Gilan (only available in this study) and Tehran (only in GLOBOCAN2002).

ARASR is more accurate than ASR in studying cancer incidence trends in registries with incomplete reporting. ARASRs in different countries or different times are comparable since they are age-standardized. Moreover, comparison between trend of ASRs and ARASRs can be used as a test for validity of registration.

1. Introduction

Cancers (malignant tumors) were responsible for 12 percent of the nearly 56 million deaths worldwide from all causes in the year 2000. In many countries, more than a quarter of deaths are attributable to cancer (Parkin et al. 2001). Based on recent available international data, there were 10.9 million new cancer cases (5.8 million men and 5.1 million women), altogether 6.7 million died from this disease, and 24.6 million people in the world living with cancer in 2002 (within five years of diagnosis). The most common cancers in terms of new cases were lung (1.3 million), breast (1.2 million), colorectal (1.0 million), stomach (933,000), and prostate (679,000) (Ferlay et al. 2004). The cancer profile varies greatly in different populations, and the evidence suggests this variation is mainly a consequence of different lifestyle and environmental factors, which can be influenced by preventive interventions (Parkin et al. 2005).

Estimation of the burden of cancer in terms of prevalence, incidence, and mortality is the first step to plan control measures in every country. The 2000 estimate represents an increase of around 23% in incidence and mortality since the previous comprehensive estimates for 1990 (Parkin et al. 2001). World population growth and ageing imply a progressive increase in the cancer burden (50% increase in incidence equal to 15 million new cases and 10 million new deaths are expected in 2020, even if current rates remain unchanged) (Parkin 2001). The World Health Organization's cancer report reveals that cancer has emerged as a major public health problem in developing countries, matching its effect in industrialized nations (WHO cancer report). The distribution of cancer between different populations and over time helps to define causal hypotheses, and to quantify the potential for prevention. Data on cancer occurrence and outcome are essential to forming health policy, by quantifying health problems, helping to define priorities for preventive and curative programs, and for evaluation of their outcomes in relation to resource inputs (Parkin et al. 2005).

Since the burden of cancer varies between countries, each nation should find its own priorities to prevent this disease. Using other populations' pattern for the countries where no data for cancer burden are available, not only is not always useful, but also can lead to wasting their scarce resources for health care. For instance, a screening program for

cervical cancer based on international recommendations in a country with very low cancer incidence and prevalence of cervix uteri diverts resources away from necessary actions for control of more common cancers or other diseases. Therefore, estimation of cancer burden is essential before starting interventions. Knowledge of regional variations of cancer burden will help to specify priorities and guidelines for budget and health policy.

At the beginning of this study, there was no valid data available for the cancer burden of Iran in recent years. There were only some scattered hospital-based cancer registers which did not provide accurate estimates for incidence rates in the population. On the other hand, there was relatively reliable evidence about high incidence of esophageal cancer in the northern Iran from a joint study by International Agency for Research on Cancer (IARC) experts and Iranian researchers which dates back more than 35 years. Due to this lack of reliable data, as the first step to learn about the present situation, a large-scale study on the incidence of all cancers seemed very necessary. Therefore, this study was designed by Digestive Disease Research Center, an affiliate of Tehran University of Medical Sciences (DDRC) to quickly ascertain the recent situation of cancer incidence in Iran by a 5-year retrospective active registration of all accessible records of cancer patients (1996–2000) in a vast area of Iran (5 provinces of Ardebil, Gilan, Mazandaran, Golestan and Kerman which constitutes around 16% of the whole population of Iran). The role of the author of this dissertation started right after the data collection and includes coding, data management, data analysis, assessment of data quality, development of two methods to improve data validity, presentation of results, and interpretation of results.

The rest of this chapter is about some basic concepts of descriptive epidemiology used in this dissertation, principles of cancer registration and health care system in Iran.

1.1 Basic concepts

There are several measures of cancer burden in a population. The following discussion is presented specifically in relation to cancer, though in most instances the terms discussed have general application.

1.1.1 Measures of occurrence of cancer

To perform epidemiological research for quantifying the occurrence of diseases in population, three items must be clearly defined:

1. What is meant by a case, i.e., an individual in a population who has the disease, or undergoes the event of interest (e.g., death).
2. The population from which the cases originate.
3. The period over which the data were collected (dos Santos Silva 1999, 57).

1.1.1.1 Frequency

Frequency is the measurement of the number of times that a repeated event occurs per unit time. To calculate the frequency, one fixes a time interval, counts the number of occurrences of the event within that interval, and then divides this count by the length of the time interval. In epidemiology, it can be the number of occurrences of an event such as new cases of cancer in a defined population over a specified period of time.

1.1.1.2 Prevalence

Point prevalence is the proportion of existing cases (old and new) in a population at a single point of time. Although as with any proportion, prevalence has no time unit, the point in time to which it refers must always be specified (dos Santos Silva 1999, 58).

1.1.1.3 Risk

Risk is the proportion of people in a population that is initially free of disease who develop a disease within a specified time interval. Risk is calculated by number of new cases of disease arising in a defined population over a given period of time divided by number of disease free people in that population at the beginning of that time period. This measure of incidence can be interpreted as the average probability or risk that an individual will develop a disease during a specified period of time. Risk has no time unit, however as its value increases with the duration of the follow-up, the time period to which it relates must

always be clearly specified (dos Santos Silva 1999, 60). To calculate the risk accurately, the population under follow-up should be closed (no new person enters and nobody exits), so every person free of disease at the beginning of the time period should be followed up to the end of the period although this is not often the case in reality. Therefore, this is a limitation of using risk which does not allow us to take into account information of persons who are called "lost to follow-up" before the end of the specified time period.

1.1.1.4 Incidence rate

Incidence rate is a measure of the frequency (also called incidence density) with which an event, such as a new case of illness, occurs in a population over a period of time. The numerator is the number of new cases of disease occurring in a defined population during a given time period; the denominator is the total person-time at risk during that period (dos Santos Silva 1999, 63). The person-time can be calculated by the number of people at risk multiplied by the time they were followed-up; for instance, for a source population of one million, when they all were followed-up for three years, the total person-time is three million person-years. However, sometimes the person-time is calculated for individuals separately (if they were not followed-up equally or entirely) and are summed to calculate the total person-time (e.g. in cohort studies).

Incidence can be as a rate per 100,000 persons per year or even per million person-years. It provides an approximation of the average annual risk of developing a disease (i.e. cancer), which is (after age-adjustment) useful in making comparisons between populations (countries, ethnic groups, or different time periods within a country for example) if age-standardized rate is used (Stewart and Kleihues 2003, 18). Ideally, we would like to know the risk of an individual in the population being diagnosed with cancer at a given age and specific point in time ($x_{t,}$ the instantaneous incidence rate or force of incidence at age x and time t). In practice, we are only able to estimate x_t by observing the rate of occurrence of new cases of cancer in the population over a specific time period (the incidence rate) (Parkin et al. 2002).

Crude rate is the simplest summary measure of incidence in a population, given by number of cases of all ages during a specific time period divided by total population-time at risk in that period or $\sum_x k_x \Big/ \sum_x m_x$ where k_x and m_x denote, respectively, numbers of cases and

the person-years at risk in age group x. Actually information about the age of cases or the age structure of the population at risk is not needed to calculate the crude rate. The only data required are total number of cases in a defined period of time and the total population-time at risk. Crude rates, however, are not satisfactory for comparing populations. This is because some of the observed variation in the crude rates might be due to differences in the age structures of the populations being compared.

In order to calculate the incidence rate, a count of the number of new cases is required which have occurred in the population during the period under study and an estimate of the person-time at risk (*person-years at risk*). It is important to understand that the denominator in the calculation of an incidence rate should be defined in terms of units of person-time rather than simply the number of persons in the population at a specific point of time -as enumerated in population censuses or estimated by national bureau of statistics- (Parkin et al. 2002).

1.1.1.5 Age-specific rates

The age-specific rate for age group x, λ_x, is calculated as $\lambda_x = k_x / m_x$ where k_x and m_x denote, respectively, numbers of cases and the person-years at risk in age group x. For presentational purposes, it is conventional to multiply λ_x by 100,000 to show a rate per 100,000 person-years at risk (or multiply by million for rate per 10^6 person-years). To calculate age-specific rates, both the age group of cases and the age structure of source population are needed.

The number of cases observed, and therefore also the rate, is subject to random variation. The nature of the variation in count data is dealt with by using the theoretical probability distribution known as the Poisson distribution. To have an accurate estimate of the theoretical rate x and because of random variation, the larger the number of observations of k_x, the more accurate the estimate would become. In descriptive cancer epidemiology we are restricted to a single observation of k_x, but one can use the Poisson distribution to determine how confident one can be that the true value of x lies within a specified range of values centered on our 'best estimate' of x which is λ_x. This is called a confidence interval. Another method of taking the random variation into account is to calculate and present p-value, which is the probability of chance in obtaining an estimate such as rate.

Age-specific rates provide an indication of how cancer risk develops with age in a population. It is also the preferred starting point when comparing incidence in two populations. Plots of the age-specific rates can alert the researcher to anomalies in the data or to features which might suggest birth cohort effects or differences in patterns of exposures to risk factors or other lines of investigation for further analysis.

Usually, cancer incidence increases rapidly with age. It is useful to plot age-specific curves on a logarithmic scale because the data points for the low incidence young age groups are not obscured by the large values for older age groups. Another advantage is that differences in age-specific rates between populations are often approximately proportional on the arithmetic scale and therefore constant on the logarithmic scale.

1.1.1.6 Age-standardized incidence rate (ASR)

Age-standardization is a way of accounting for the population age structures under study and a number of methods of calculation are available. The direct method involves applying the age-specific rates in the population of interest to a fixed reference or standard population. In other words, this is incidence rate weighted with a set of external reference values (weights). The most frequently used standard population is the world standard population, so that the all ages world rate is calculated as $\sum_x \lambda_x w_x$ where w_x is the proportion of the total standard population in age group x of the standard 18 age groups and λ_x is the age-specific rate for age group x. Therefore, to calculate the ASR, in addition to age group of cases and age structure of source population, proportion of the total standard population in each age group is needed (Table 1). A disadvantage of using the world standard population for standardization of incidence data for more developed country populations is that a large proportion of the world standard population is in young age groups, whereas most cases of cancer occur in older age groups. This means that disproportionately more weight is attached to the incidence rates for younger as opposed to older age groups although it is not a real problem for comparisons.

Table 1. World standard population used for computation of age-standardized incidence rates

Age group (yr)	World (n)
0–4	12,000
5–9	10,000
10–14	9,000
15–19	9,000
20–24	8,000
25–29	8,000
30–34	6,000
35–39	6,000
40–44	6,000
45–49	6,000
50–54	5,000
55–59	4,000
60–64	4,000
65–69	3,000
70–74	2,000
75–79	1,000
80–84	500
85+	500
Total	100,000

The age-standardized rates can be adjusted to account for the *cases of unknown age*. This can be done simply by multiplying the standardized rate, based on cases of known age, by T/K where T is the total number of cases of cancer of the same type in persons of the same sex; K is the number occurring in persons of known age. The standard errors can also be multiplied by the same correction factor T/K. The assumption underlying this correction is that the ages of cases are missing randomly; the probability that the age of a case is unknown does not depend on the age of the case (Parkin et al. 2002, 88). If this assumption is violated, it may cause bias in the results although the extent of this bias depends on the percentage of cases of unknown age out of all cases.

An alternative form of age-standardization, known as the indirect method, involves calculating the ratio of the total number of cases observed in a population, $O = k_x$, to the number of cases which would be expected, E, if the age-specific rates of some reference population applied. The expected number of cases in a comparison population is given by $\sum_x m_x \lambda_x$ where the λ_x is age-specific rate for the reference population in age group x and m_x denotes number of persons in the population of interest in age class x. The standardized incidence ratio (SIR), expressed as a percentage, can then be calculated as $SIR=O/E \times 100$ (Estève et al. 1994).

1.1.1.7 Cumulative rate and cumulative risk

A feature of both the direct and the indirect methods of standardization is the necessity of choosing an arbitrary reference population. This can have misleading results if the structures of the study and reference populations are grossly different. An alternative proposed by Day (1987, 787–789) is based on the sum of age-specific rates, giving equal weight to all age groups. In fact, each age-specific rate is multiplied by the length of the age group in years, which is 5 years for all age groups up to 80–84. The oldest age groups are usually excluded since we are interested in the cumulative incidence up to a specific age. Thus the cumulative rate up to age 70 is calculated as $\sum_{x=1}^{14} 5\lambda_x$ from which the cumulative risk, expressed as a percentage, can be estimated as $(1 - e^{-Cumulative\ \ Rate}) \times 100$ (Parkin et al. 2002, 87). The difference between cumulative risk and rate is small when the value of cumulative rate is less than 10. For instance, the cumulative risk $100(1–e^{-x})$ for values of cumulative rate (100x) 0.5, 5 and 7% are 0.499, 4.88 and 6.76% respectively.

The cumulative risk can be interpreted as an approximation to the cumulative 'lifetime' (age 0–69 inclusive) risk of disease for an individual if, throughout their life, they were to experience the same age-specific risks as the population from which the cumulative rates were calculated, and were free from competing causes of death. The percentage cumulative risk provides a statistic which is comprehensible to lay people. For example, if someone is told that they have a 10% lifetime risk of lung cancer, this is more likely to dissuade them from smoking than the information that the ASR of lung cancer is 80 per 100,000 person-years.

1.1.2 Validity

Validity is equivalent to lack of systematic error (bias). The validity of a study is usually divided into two components: the validity of the inferences drawn as they pertain to the members of the source population *(internal validity*), and the validity of the inferences as they pertain to people outside that population (*external validity* or *generalizability*) (Rothman and Greenland 1998, 118). Validity in cancer registration is defined as the

proportion of cases in a dataset with a given characteristic (e.g., site or age) which truly have the attribute (Parkin et al. 2002, 68). Data validation in the process of cancer registration is to ensure that the quality of data is as high as possible and no invalid codes are fed into the database, these may take the form of a range check (for example, that no patient's age can be less than 0 or greater than, say, 110) (Jensen et al. 1991). The term "accuracy" is a rather similar concept which denotes the degree of conformity of a measured or calculated quantity to its actual, nominal, absolute, or some other reference value.

1.1.3 Reliability

Reliability, sometimes also called repeatability or reproducibility, is a measure of the consistency of the performance of the test when used under similar circumstances. To be valid, measurement must be reliable. However, reliability is not in itself sufficient for validity: in other words, a test may yield the same result consistently, but the result may not be the true (valid) one (dos Santos Silva 1999, 25). The term "precision" is a rather similar concept which characterizes the degree of mutual agreement or repeatability among series of individual measurements, values or results or in other words it is lack of random error (Rothman and Greenland 1998, 116).

1.1.4 Confidence interval

In strict terms, the confidence interval is a range of values that is likely to cover the true population value but we are not certain that it will. The confidence interval is based on the concept of repetition of the study under consideration. Thus if the study were to be repeated 100 times, we would expect 95 of the 100 resulting 95% confidence intervals to include the true population value (dos Santos Silva 1999, 106).

1.2 General principles of cancer registration

Cancer registration starts with collecting data about patients with malignant diseases (and in some cases includes some benign tumors as well). The data collected identify the demographics of the patient with the disease, the type of cancer, and sometimes how it is

treated and the outcome of the patient. The data collected are kept in a cancer registry, a term which can simply mean the database or data system that manage and analyze the information, or data system and all of associated systems and personnel who perform cancer surveillance and cancer control (Gail and Benichou 2000, 127).

1.2.1 Cancer registration types

Hospital-based cancer registration is the process of making a cancer database maintained in a health care facility and providing information on all cancer patients who use the services of that facility for diagnosis, staging, and treatment. Hospital-based cancer registry records all new cases in a given hospital, usually without knowledge about the background of population (Jensen et al. 1991, 23). The service population for a hospital-based registry may not be definable and varies from facility to facility, depending on the types of specialty treatment it offers, the types of third-party payers it attracts, and a number of other factors. As a result, the number of potential patients in the facility's customer base can only be estimated. A hospital-based cancer registry can calculate frequency of cases and measure outcomes for patients it monitors. A hospital-based cancer registry cannot provide incidence rate because the denominator population at risk is not known (Gail and Benichou 2000, 127).

Population-based cancer registration is done in a centralized cancer registry with a database covering a known population, usually residents of a defined geographic area, such as a county or state. Because the population denominator can be counted or estimated by census, a population-based registry can provide incidence rates. Population-based registries are the principal source of cancer surveillance data. Population-based cancer registries must collect information on cancer patients from variety of sources, including registries in hospital and other healthcare facilities, physician offices, pathology laboratories, and sometimes facilities outside the defined geographic area to which residents travel for cancer diagnosis and treatment. The hospital registry may form the nucleus for a population-based cancer registration scheme (Jensen et al. 1991, 23). Population-based cancer registries can be of two types: (1) those that report incidence only (the first report of a new cancer) or (2) multipurpose registries that collect data on incidence and subsequent outcomes such as prognosis or death (Gail and Benichou 2000, 127).

Methods of data collection (notification methods) traditionally have been classified as active or passive. Active reporting (collection at source) involves registry personnel actually visiting the sources of data and abstracting the required information onto special forms or obtaining copies of necessary document. Passive (or self-) reporting relies upon other health care workers to complete notification forms and forward them to the registry, or to send copies of discharge abstracts etc. from which the necessary data can be obtained. This passive process also can be automated (computerized). In practice, a mixture of these two systems may be used, with, for example, active hospital visits being supplemented by passive receipt of copies of pathology reporting forms and death certificates mentioning cancer (Jensen et al. 1991, 37).

1.2.2 Registry operations

The four main aspects of registry operations are: case ascertainment, abstracting and coding, follow-up or mortality follow-back and quality control.

Case ascertainment

Case ascertainment, also called case finding, is the process of identifying patients with malignant disease who meet the criteria for inclusion in the registry. Because cancer surveillance requires monitoring of cancer incidence and mortality, case ascertainment must identify all cases of the disease in that defined population, regardless of where the cancer patient encounters the healthcare system; including hospitals, independent treatment centers, clinics, pathology laboratories, physician offices, and nursing homes (Gail and Benichou 2000, 128). The main source of information is usually hospitals, or cancer centers, but depending on the local circumstances, a population-based registry also involves private clinics, general practitioners, laboratories, coroners, hospices, health insurance systems, screening programs and central registers (Jensen et al. 1991, 29).

Most cancer patients come to a hospital at some points in their disease process, usually for a biopsy or treatment; thus, hospital medical records are an important source of case-finding. In hospitals, medical records are coded and indexed by disease and procedure so that patient records can be retrieved for analysis. The database containing these codes is one of the principal sources of case ascertainment in a healthcare facility. Specific codes

for cancer diagnosis and treatment permit retrieval of records related to reportable neoplasms that must be included in the registry (Gail and Benichou 2000, 128).

A neoplasm is a "new growth' or tumor that developed somewhere in the body. The term neoplasm refers to, benign, malignant (having the potential to spread from site of origin and ultimately kill the patient) or borderline tumors (uncertain whether benign or malignant). A reportable neoplasm is a tumor that meets the inclusion criteria for a registry. Reportable neoplasms are well defined in the *International Classification of Disease for Oncology*, a coded nomenclature published by World Health Organization (WHO). This coding system defines each type of tumor and its behavior: benign, uncertain malignant potential, *in situ*, invasive, or metastatic. The reportable neoplasms collected by all general-purpose cancer registries are those that are malignant (*in situ* and invasive). Metastatic tumors (malignancy growing in a site at a distance from origin in which started) are not reported individually; rather, metastases are reported as progression of the tumor at the site of origin. Occasionally a central registry will require that another type of tumor be reported, such as benign brain tumor, which cannot spread but do have the potential to be lethal, and tumors of uncertain malignancy, such as carcinoids of appendix. On the other hand, a few cancers are very common and are associated with such a good prognosis that it is generally not of public health importance to monitor their outcomes, such as basal cell and squamous cell carcinomas of the skin (Tyczynski et al. 2003, 10) and carcinoma *in situ* of the cervix.

Abstracting and coding

Abstracting is the process of deriving and recording relevant data about each reportable case. The resulting document, the *abstract*, is an abridgment or summary of what happened to the patient, and may be in paper or electronic form. Data items include personal identification and demographics of the patient (at least name, sex, date of birth or age, and address), a description of the disease (site of origin, type of malignancy), stage at diagnosis (documentation of how far the cancer had spread when it was diagnosed), and treatments (Jensen et al. 1991, 29) as well as incidence date and most valid bases of diagnosis (Tyczynski et al. 2003, 1).

Parts of the abstract are encoded, such as site and type of cancer, stage, and treatment. In addition to the standard data items, some registries collect information on items of special

interest, such as smoking history, family history of cancer, or co-morbid conditions. As noted previously, a population-based cancer registry can be either incidence-only or multipurpose. If the registry is incidence-only, then the registry does no outcome assessments. However, outcome measurement is for describing the results of treatment and disease process in terms of survival rates and mortality. Abstracting rules and guidelines have been developed to cover nearly every situation, but human interpretation of both the facts of case and the rules of abstracting can sometimes cause problems, and there is always the danger of incorrect data entry. As a result, a series of edits have been developed and included in most cancer registry database systems (Gail and Benichou 2000, 128).

There are several types of edits, including range checks and logic checks. The simplest edits are range checks or allowable codes. Logic checks are a type of inter-item edit where the program searches in two or more data fields to ensure that they make sense together. For example, an error message should be generated when 'sex' is male and "primary site' is cervix. Inter-item edit can be quite complex, such as searching for a morphologic disease code as noninvasive, the corresponding stage at diagnosis coded as *in situ*, the method of diagnostic confirmation coded histologic, and the sites of distant metastasis field that should be left blank (Jensen et al. 1991, 104–106). Computer edits such as these are the first line of protection against inaccurate data. Other editing mechanisms and preventive measures such as training and standardization of procedures are described in the following on data collection and quality control (Gail and Benichou 2000, 129).

An additional function of population-based central registries is case consolidation or case matching. Because the registry receives reports from many sources, it is necessary to identify multiple reports on the same patient so that the case is not counted more than once and there are no duplicate registrations for the same tumor (Jensen et al. 1991, 82–83). Case consolidation involves not only various computer algorithms but human review as well. For example, Hospital A might send a report on Rich Smith with a birth date of November 19th, 1935 and a diagnosis of sigmoid colon cancer, and Hospital B might send in a report on Fredric Smith with a birth date of November 18th, 1935 or November 19th, 1935 and diagnosis of rectal cancer. The registry must decide whether these reports are about the same patient, and, furthermore, whether they are about the same cancer. Without a case consolidation operation in the registry, the numerator (newly diagnosed cases) of the incidence rate may be inflated (Gail and Benichou 2000, 129).

Occasionally a patient with cancer will be missed in the case ascertainment process and not be abstracted into the registry database. Missing a case leads to under-estimation of the incidence rate for that particular cancer. Thus high completeness is important for accurate cancer data. If a previously unreported cancer patient dies, a cancer diagnosis on death certificate may be the first and only report of the cancer case. It is good policy for a registry to follow-back a *death certificate only* (DCO) case to find out where it was missed in the case finding process. *Trace-back* is the process of contacting physicians and facilities noted on the death certificate to review their medical records to determine any earlier diagnosis or treatment of the cancer (Parkin et al. 1994, 49). In many instances, the case was simply missed, so the abstract is processed as a late report and reporting-source procedures are investigated. In other instances, death certificate diagnosis is the only identification of the case. These cases are tagged as DCO in database, and usually very little information is available about them (Gail and Benichou 2000, 130). A registry monitors its percentage of DCOs as part of its quality control processes; number of DCO cases as a proportion of total incident cases is an indicator of validity (Parkin et al. 1994, 45).

Quality control

Quality control encompasses all the registry activities that monitor and resolve data problems. Quality control usually deals with facts and data items. On the other hand, quality improvement or quality management usually deals with procedures and processes. Quality control is performed on all aspects of registry operations. Standards have been established for case completeness, database completeness, accuracy and reliability of data, and timely reporting of cases to the registry. The purpose of quality control is to determine whether these standards are being met (Gail and Benichou 2000, 131).

Quality has been defined as “fitness for use”. Analysis of data which are not fit for use can result in incorrect conclusions and inappropriate cancer control and cancer surveillance activities. The principal components of data quality are accuracy, completeness and timeliness. Completeness has at least two aspects: completeness of database and completeness of data in each record. Completeness of database means that all cases in the population under investigation have been included for specified time period. Without a complete database, incidence rates and relative frequencies may be inaccurate. Completeness of the database is a function of thorough case ascertainment, described

above. Completeness is assessed by several techniques, including re-casefinding studies, projections of the number of cases reported in previous years, and the ratio of incidence to mortality for all cancers combined and for selected cancers (Gail and Benichou 2000, 131). Completeness of data in each record means that all the variables (sex, age, pace of residency, topography, morphology, etc.) for each record (e.g. each person) are filled.

1.2.3 Data validity

Validity is an essential component in assessing the quality of cancer registry data. It is operationally defined as the proportion of cases in the registry with a given characteristic (e.g. cancer site, or age) which truly have the attribute. Thus, the validity of recorded data depends upon the accuracy of data source documents (correctness and lack of error), and the quality in abstracting, coding and recording this information for the registry data base (Parkin et al. 1994, 42).

Goldberg et al. (1980) identified three methods of evaluating validity: (1) diagnostic criteria method, (2) re-abstracting record method, and (3) internal consistency methods. To these might be added the percentage of registrations with missing information for indicator variables. The *diagnostic criteria method* determines the percentage of registered cases fulfilling criteria of diagnostic accuracy. For cancer registries, the percentage of cases histologically verified is considered positive indicator of data validity, while the percentage of cases registered on the basis of information on death certificate only is considered a negative correlate of validity (Parkin et al. 1994, 42).

The proportion of cases with *missing information* for indicator variables is also an indicator of validity. Thus, the percentage of cases registered with an unknown or ill-defined primary site is clearly related to quality of diagnostic information. A high percentage of cases with unknown age may occur in populations with many persons unsure of their age, or alternatively may result from careless or incomplete record keeping or having no population registry. The *re-abstracted record method* is the most objective method of evaluating validity. It relies upon a careful comparison of the registry record with documents relating to the case, usually by an independent observer (Parkin et al. 1994, 42).

The *internal consistency method* is a checking for impossible codes or impossible and implausible combinations of codes for different variables in the same case record (Jensen et al. 1991, 212). The usefulness of internal consistency checks in evaluating validity is limited. Clearly, only impossible codes or combinations can be identified in a single stage. Unlikely combinations of codes (age vs. site/histology, site vs. histology) require verification via source documents to identify errors. All incorrect codes and combinations cannot be identified. Nevertheless, the percentage of records deemed impossible or unlikely, provides an approximate indication of the validity of the data. It is nonetheless important to monitor internal consistency of registry data, i.e. to determine whether the data appear to be of the type expected and whether there is coherence between the individual data types. The complexity of this type of quality control operation varies from a rapid visual scan of an abstract to check all the essential items, to extensive edit programs carried out by computer which are designed to flag any inconsistency (Parkin et al. 1994, 60).

1.3 Cancer registration in developing countries

At first sight, it may seem that cancer registration is a luxury that ought to occupy a lowly place in the priorities of health services of a developing country, given the many competing demands upon usually slender financial resources. Yet this would be a mistaken belief, firstly because cancer is already a significant health problem in the developing countries of the world, and one that is likely to increase in the future, and secondly because the presence of adequate information is an essential part of any cancer control strategy (Jensen et al. 1991, 185).

Over 10 million new cases and over 7 million deaths from cancer occurred in 2000. The contribution of developing countries was 53% for incidence and 56% for deaths. But the future is more alarming since, by 2020, the total number of new cases is expected to increase by 29% in developed countries whereas, in developing countries an increase of 73% is expected, largely as a result of ageing, urbanization and change in dietary habits (Boutayeb 2006). The young age structure of the developing countries means that the overall (crude) incidence rates appear to be low, even though age-specific risk may be a little different from that in the developed world. The young age of the population does mean, though, that much of the burden falls upon individuals in the active age range of 25–64, with a correspondingly great impact on family life. Moreover, the size of this problem

is bound to increase, given the rapid increase in population of many of these countries and with control of infectious disease and reducing of family size, and so increase in the proportions of the elderly (Jensen et al. 1991, 185).

In general, cancer registration is a laborious task in developing countries, owing to shortages of medical facilities and personnel. The problem of identification of individuals, comprehensive case finding and definition of the reference population are most difficult to solve, and the risk of bias is always present. It is wise to start simply with reports of relative frequencies by sex and ethnic group, but the ultimate objective should be to register cases from a defined population so that incidence rates can be calculated, even though these, initially, maybe underestimates of the true rates (Jensen et al. 1991, 198).

Regarding the optimal size of population covered by a cancer registry, there is no firm recommendation or rule. In practice, however, most cancer registries operate with a source population of between one and five million. With larger populations it may be difficult to maintain completeness or quality of the data; with smaller populations it takes longer to obtain meaningful figures. In countries with large populations, autonomous but linked regional registries may be more effective if facilities and resources allow operating this way. In smaller countries, national registration is feasible, such as in Kuwait with 1.9 million people (Parkin et al. 2002). For countries in which national coverage is difficult to achieve, it is preferable to set up smaller registries in representative areas, as is done in the Indian Council of Medical Research cancer registry network (Jensen et al. 1991, 25).

Based on information in latest version of the book “Cancer Incidence in Five Continents Vol. VIII” there are only three countries around Iran that have population-based cancer registry (Parkin et al. 2002). They are all in the southern part of Iran, Pakistan in the southeast (1995), Oman in the south with Oman Sea as the border (1985) and Kuwait in the southwest with Persian Gulf as border (1971; Figure 4). Oman and Kuwait are small Arab countries with nationwide cancer registry, but Pakistan has only cancer registry in its largest city, Karachi. Although these countries are different from Iran in many aspects, their religion, Islam, is common.

1.4 Cancer registration in Iran

The need for cancer registration was recognized decades ago, but as the country was in challenging political changes four decades ago (government shifting from kingdom to republic and involving in a long devastating undesired war with Iraq), scarce resources for health care were not basically allocated to surveillances and registrations. However, in 1984 a bill was passed by the National House of Representatives (Parliament) enacting a compulsory report of cancer cases to Ministry of Health and Medical Education so that any tissue removed from living persons (biopsy) should be sent to a pathology laboratory and laboratories are obliged to report neoplastic cases to the Ministry of Health. This was a good basic action that led to microscopic verification of the majority of cancer cases in recent years. Some efforts were made to start a nationwide cancer registry. As Iran is a relatively large country, it takes a lot of resources. Therefore, only pathologic-based cancer registration has been incompletely launched. Established cancer registries in Iran in the past and present are as follows:

1.4.1 Babol (Mazandaran) cancer registry

Cancer registration in Iran dates back to 1968 when IARC and IPHR tried to figure out the incidence of esophageal cancer in Caspian Littoral. This was the only population-based cancer registry in Iran, but unfortunately it ended after about 4 years but had a great impact on alarming the authorities and researchers to investigate the possible reasons for the highest reported incidence rate for esophageal cancer in the world in the southeastern part of the Caspian Sea where Turkmen live.

1.4.2 Tehran cancer registry

The first initiative came from the Cancer Institute of Tehran University (recently designated as a National Research Center) in 1998–9. The registry aims to collect data from all hospitals and laboratories in Tehran city (population more than 6 million). It is a major task, as there are 236 hospitals and 150 laboratories. Most cases (>80%) are from just 10–11 hospitals, and the aim is to encourage hospital-based registries in these hospitals. A

major problem remains distinguishing permanent from temporary residents, and to obtain address of patients in cases detected in pathology laboratories. The first year data (1998) has been analyzed, although it is felt that this was something of a trial year and results have not been published anywhere.

1.4.3 Shiraz (Fars Province) cancer registry

The Shiraz registry dates from 1970's. It is based upon registration of cancer patients treated in the Department of Radiotherapy in Namazi Hospital, plus cases diagnosed in the Pathology Department. In fact, the registry is combining these traditional two sources, together with case finding in four hospitals in Shiraz. Seven registry stuff (graduates in medical record technology) interview all patients found in patients services. The interview form is fairly complex and includes records of fertility variables, height, weight, smoking etc. The only output from this registry has been frequency data in spite of their detailed questionnaire for each cancer patient.

1.4.4 Cancer registries in Ardebil and Gonbad

In parallel with this study and after a feeling of need for a continuous systematic population-based cancer registry in the high incidence upper GI cancer areas, DDRC has established two active registries with permanent staff in Ardebil and Gonbad (eastern part of Golestan province) since 2003.

1.4.5 National cancer registry

The national registry is the responsibility of the Diseases Control Department of the Ministry of Health and Medical Education. The registry has undergone several modifications in strategy over the years. The obligation to notify the cancer registry of new cancer cases has been a legal requirement since 1994. But reporting to the Ministry of Health registry was far from complete. In the last few years, the strategy has been to

develop a system of national pathology registration, aiming, given the department's limited budget, to automate the process as far as possible.

Pathology departments throughout the country are being supplied with specially designed software (pathology accession and reporting system, PARS). This allows pathology departments to create their own database, based on specimens examined either all specimens or just cancer cases. It includes the facility, making it useable by beginners with minimal knowledge of ICD-O. A national model pathology notification form has been introduced, which designed to obtain demographic details of cases including full name and address. It is hoped that use of this form will be a prerequisite for reimbursement by insurance companies. A personal national unique ID has been issued for everybody in Iran recently but still is not completed to be used in the registries. The problems with this national registry are being only pathology based and the incomplete coverage of all pathology centers as well as having no output since establishment.

1.5 Health care infrastructure in Iran

During the 1960s and 1970s, the country experienced the expansion of health services through "Health Corps and Pilot Projects of Primary Health Care." However, it is since the Islamic Revolution in 1979 that the country's health policy has been based on primary health care, with particular emphasis on expansion of health networks and programs in rural areas and with priority allotted to preventive over curative services.

Recently, priority areas have included: reduction of population growth by use of family planning; control of diarrheal, respiratory and iodine deficiency diseases; integration of mental health, tuberculosis, leprosy, diabetes, and malaria programs into the primary health network system. In addition, community-oriented medical education; considerable increase of immunization coverage; reduction of maternal and infant mortality; increase of community participation; increase of basic environmental sanitation and adequate safe water in rural communities; and expansion of health networks, including the construction of district hospitals where needed. There is also the new policy of vaccination of women, which requires that all women of childbearing age, not only pregnant women, be immunized against tetanus.

The health budget doubled in 1991 compared with 1982–87. The declared policies have been made known to the different levels of government and nongovernmental sectors through the mass media as well as through publications and brochures.

Many laws and regulations have recently been decreed which support the *health for all* policy. These include the law of economics, social and cultural development; this states that deprived areas should receive equal services with other areas so that, within eight years' time, there should be no deprived areas in the country.

Since April 1985, the expansion of health networks based on primary health care has been rapid. In both towns and villages, the first point of contact between the public and the health system is the health centre. However, in the villages, the health center performs its functions with the help of a large number of health houses, which effectively become the first point of contact. The responsibility of the rural health centre is to supervise, support and accept referrals from the health houses.

District hospitals in towns offer services to referred cases from rural as well as urban health centers. District hospitals are responsible for higher level services to hospitalized and outpatients. The activities of the district health centers, as well as those of the district hospitals, are coordinated by the manager of the health network. Although, formally, this referral follow-up chain exists, it is somewhat weak, especially at the level of the rural health centre upwards.

In addition, a shortage of doctors and to a lesser extent, the flight from the country of health professionals, including doctors, at the time of the revolution, has led to many rural health centers being staffed by expatriates, which affects the feedback and referral mechanisms and has decreased support for the health houses. This is being solved through a dramatic increase in the number of medical graduates and the formation of the Ministry of Health and Medical Education, which puts many medical facilities in service of training. Low literacy rates, especially in some rural areas and among girls, has made it difficult to find suitable candidates to be trained as community health workers and is affecting the expansion of the primary health care network in some parts of the country. Moreover, a shortage of funds and suitable facilities for health centers is also among the major obstacles impeding expansion of the primary health care network.

National health policies are decided at meetings of the Council of the Undersecretary of the Ministry of Health and Medical Education, headed by the Minister of Health and Medical Education. However, the initial information on needs for planning purposes is collected from the bottom up. In each district, there is a district planning council, to which each sector submits its planning needs in priority order. The plans approved by this council are referred for formal consideration to the provincial council, which, with due consideration of provincial priorities, coordinates the plans and ultimately sends them to the planning councils at the national level. The planning process is thus a two-way one: both top-down and bottom-up.

The health network has been decentralized to district level so that implementation of programs is independent of central administrative and financial control. Entrusting full administrative and financial powers to provincial and district health centers has greatly facilitated the implementation of health for all strategies.

An important development is the abovementioned establishment of the Ministry of Health and Medical Education, which combines responsibility for provision of health services and medical training. In each province, there is at least one university of medical sciences and health services. The chancellor of this university is in charge of all health affairs in the province, executing his duties through deputies for health, treatment, and so on. He also works with the deans of different health-related schools.

The communities are actively involved in the planning and implementation of health services, mainly through the health councils in rural areas. The decentralization of administrative and financial management of health services has also increased community participation; this is in addition to the fact that all personnel working in rural health centers and health houses are locally recruited. Community involvement in large cities is not as impressive.

In 1990, the Ministry of Health and Medical Education's budget represented 12.9% of the total government regular budget while in 1998, expenditure of the social sectors, education, health and social security constituted 32.8% of total government expenditure. Approximately 40% of the Ministry of Health and Medical Education's budget is spent on the primary health care system. The per capita total expenditure in health at international $ rate has been 498 in 2003. In 2004 GDP per capita has been US$ 8,367 and total health expenditure as percentage of GDP has been 6.5 percent in 2003 (WHO website).

Public health and primary health care now account for 13% of the medical curriculum. In 2003, per 10,000 population, there were 4.5 government-employed physicians, 0.91 dentists and 13.8 nursing/midwifery personnel. However, despite government incentives to attract physicians to rural, deprived areas, the distribution of physicians is very inequitable, with urban areas having rates of physicians more than 20 times higher than those in the deprived areas.

As regards physical resources, there were 14.6 hospital beds per 10,000 population in 1988, rising to 16.3 in 2001. Available health facilities in 1988 included 8000 health houses, 3015 health centers and 140 district health centers. The organization chart of primary health care system is shown in Figure 1.

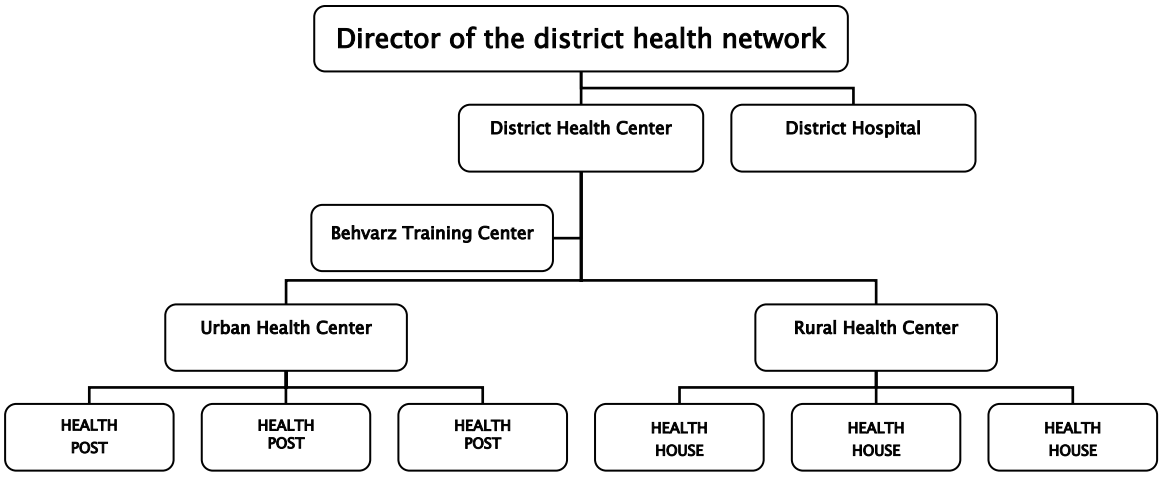

Figure 1. Primary health care system in Iran.

Implementation of “health for all” strategies has improved the health status of the population, as indicated by the decreased mortality and increase in life expectancy (from 50 years in 1960 to 68–72 in 2004). More than two-thirds of the population is currently covered by health care due to the expansion of the health centre network. Moreover, the expansion of water networks in towns and villages has resulted in 100% coverage of the urban population with safe water by year 2002 (98% covered with piped water in the home)

and hygienic sanitary facilities. In the same year, 83% of the rural population had access to safe water.

There is more efficient use of human resources through the policy of local recruitment of staff for health centers. Although resources allocated to the health sector have doubled in recent years, the fact that the district health centers have become completely autonomous units, both administratively and financially, has also resulted in more efficient use of resources.

1.5.1 Oncology care

Cancer patients have different pathways for diagnosis and treatments in urban and rural areas (Figure 1). In rural areas a referral system exists so that first patients go to their nearest health house where a trained Behvarz (health worker with education at most diploma but trained intensively for primary health care) have a file for each household in the area and if they suspect serious diseases it will be referred to a physician at the rural health center. For further investigation, patient will be referred to district health center in the city where specialists are available (mainly pediatricians, gynecologists, surgeons and internalists). For advanced diagnostic procedure and treatment of cancer specifically, patients will be referred to highest level of health care system which are hospitals. All these usually take place within the province.

This referral system is free of charge up to third level (except for drugs, for which patients have to use their insurance). For higher levels, the role of insurance companies is of great importance. There is an effort from the government to insure all rural inhabitants and it is going to be completed. Some non-governmental organizations such as the Special Diseases Foundation reimburse the expensive medicines used for treatment of cancer. Workers and employees, who have insurance from their employers, can use social security organization facilities.

In urban areas, the referral system does not work as efficiently as in rural areas. Urban residents usually go to physicians by their choice and visit a specialist without being referred by general practitioners. In general, urban people have better socioeconomic status than rural and can use the social security organization facilities if they are workers,

employees or employers. Unemployed persons have to manage their needs by themselves, their relatives, or from charity organizations such as the Emdad Committee.

Cancer cases records are best found in the hospitals (private or governmental ones). ICD coding is used in the hospital archive section but is not specialized for cancer so for a comprehensive search of cancer cases, all hospital discharge notes should be manually searched. Another place to find cancer cases is the pathology laboratories (governmental and private) which are forced by law to notify their neoplastic cases by Ministry of Health. Also, they have a computerized archive so it is very easy for the laboratories to send their data to the registry. Physicians' offices and radiology departments usually do not archive the records of their patients, so they can only be used as a minor source except for oncologist offices which often is used for cancer registration.

In this dissertation, information about cancer incidence in Iran is presented by cancer site, sex, age group, area of study, and year of study. Also, there are some discussions about quality issue and corrections made to improve the database used for this study. In addition, based on incidence rates found by this investigation and considering the change in age structure of Iran population over the time, population growth and incidence trend, cancer burden in 2010 was estimated. In addition, a new method was developed and tested to adjust for ascertainment bias in the evaluation of cancer registry data.

2. Review of the literature

In this chapter the magnitude of cancer burden worldwide and in national level will be discussed.

2.1 Magnitude of cancer burden

Cancer constitutes a major burden worldwide but there are marked geographical variations in incidence overall and at specific sites. Valid estimation of the number of new cases (incidence) requires population-based cancer registration. Compilation of worldwide age-standardized cancer rates allows the identification of countries and regions where particular tumor types are most common. Such differences usually reflect exposure to distinct causal environmental factors. In addition to providing data on the distribution of neoplastic disease, descriptive epidemiology provides the basis for prevention, health service planning and resource allocation (Stewart and Kleihues 2003, 11).

2.1.1 Global cancer burden

Worldwide, cancer takes the lives of tens of millions annually. Based on recent incidence and mortality data available, there were 10.9 million new cases, 6.7 million deaths and 24.6 million persons living with cancer (within five years of diagnosis) in the year 2002 (Parkin et al. 2005). This represents an increase of around 20% in incidence and mortality since 1990. But the future is more alarming since, by 2020, the total number of new cases is expected to increase by 29% in developed countries whereas, in developing countries an increase of 73% is expected, largely as a result of ageing, urbanization and change in dietary habits (Mathers et al. 1999).

In terms of incidence, the most common cancers worldwide (excluding non-melanoma skin cancer) are lung (12.4% of all cancers), breast (10.6%), colorectum (9.4%), stomach (8.6%), prostate (6.3%) and cervix uteri (4.5%) (Table 2). For any disease, the relationship of incidence to mortality is an indication of prognosis, similar incidence and mortality rates

being indicative of an essentially fatal condition. Lung cancer is the largest single cause of deaths due to cancer worldwide (1.1 million annually), since it has almost invariably poor prognosis (Figure 2). On the other hand, appropriate intervention is often effective to avoid death following early diagnosis of cancers such as breast cancer. Therefore, breast cancer, which in terms of incidence ranks second, is not among the top three causes of death from cancer, i.e. cancers of the lung (17.8% of all cancer deaths), stomach (10.4%) and liver (8.8%) (Stewart and Kleihues 2003, 11).

Table 2. Age-standardized rate (ASR) for world by Globocan 2002 by sex and site.

Male					Female				
Cancer site	Crude rate	ASR (World)	Cumulative rate (age 0–64)	Cases ×1000	Cancer site	Crude rate	ASR (World)	Cumulative rate (age 0–64)	Cases ×1000
					All sites but skin	164.4	161.5	9.5	5,061
All sites but skin	185.7	209.6	10.3	5,802	Breast	37.4	37.5	2.6	1,152
Lung	30.9	35.5	1.7	965	Cervix uteri	16.0	16.2	1.3	493
Prostate	21.7	25.3	0.8	679	Colon and rectum	15.3	14.6	0.7	472
Stomach	19.3	22.0	1.2	603	Lung	12.6	12.1	0.6	386
Colon and rectum	17.6	20.1	0.9	550	Stomach	10.7	10.3	0.5	330
Liver	14.1	15.7	1.0	442	Ovary etc.	6.6	6.6	0.5	204
Esophagus	10.1	11.5	0.6	315	Corpus uteri	6.5	6.5	0.4	198
Bladder	8.8	10.1	0.4	273	Liver	6.0	5.8	0.3	184
Oral cavity	5.6	6.3	0.4	176	Esophagus	4.8	4.7	0.3	146
Non-Hodgkin lymphoma	5.6	6.1	0.3	175	Leukemia	4.2	4.1	0.2	129
Leukemia	5.5	5.9	0.3	171	Non-Hodgkin lymphoma	4.1	3.9	0.2	125
Larynx	4.5	5.1	0.3	139	Thyroid	3.4	3.3	0.2	103
Kidney	4.1	4.7	0.3	129	Pancreas	3.5	3.3	0.1	107
Pancreas	4.0	4.6	0.2	124	Oral cavity	3.2	3.2	0.2	98
Other pharynx	3.4	3.8	0.3	106	Melanoma of skin	2.6	2.6	0.2	81
Nervous system	3.5	3.7	0.2	108	Nervous system	2.6	2.6	0.2	81
Melanoma of skin	2.5	2.8	0.2	79	Bladder	2.7	2.5	0.1	82
Nasopharynx	1.8	1.9	0.1	55	Kidney	2.6	2.5	0.1	79
Multiple myeloma	1.5	1.7	0.1	46	Multiple myeloma	1.3	1.2	0.1	39
Testis	1.6	1.5	0.1	48	Other pharynx	0.8	0.8	0.1	24
Thyroid	1.2	1.3	0.1	37	Hodgkin disease	0.8	0.8	0.1	24
Hodgkin disease	1.2	1.2	0.1	38	Nasopharynx	0.8	0.8	0.1	24
					Larynx	0.6	0.6	0	20

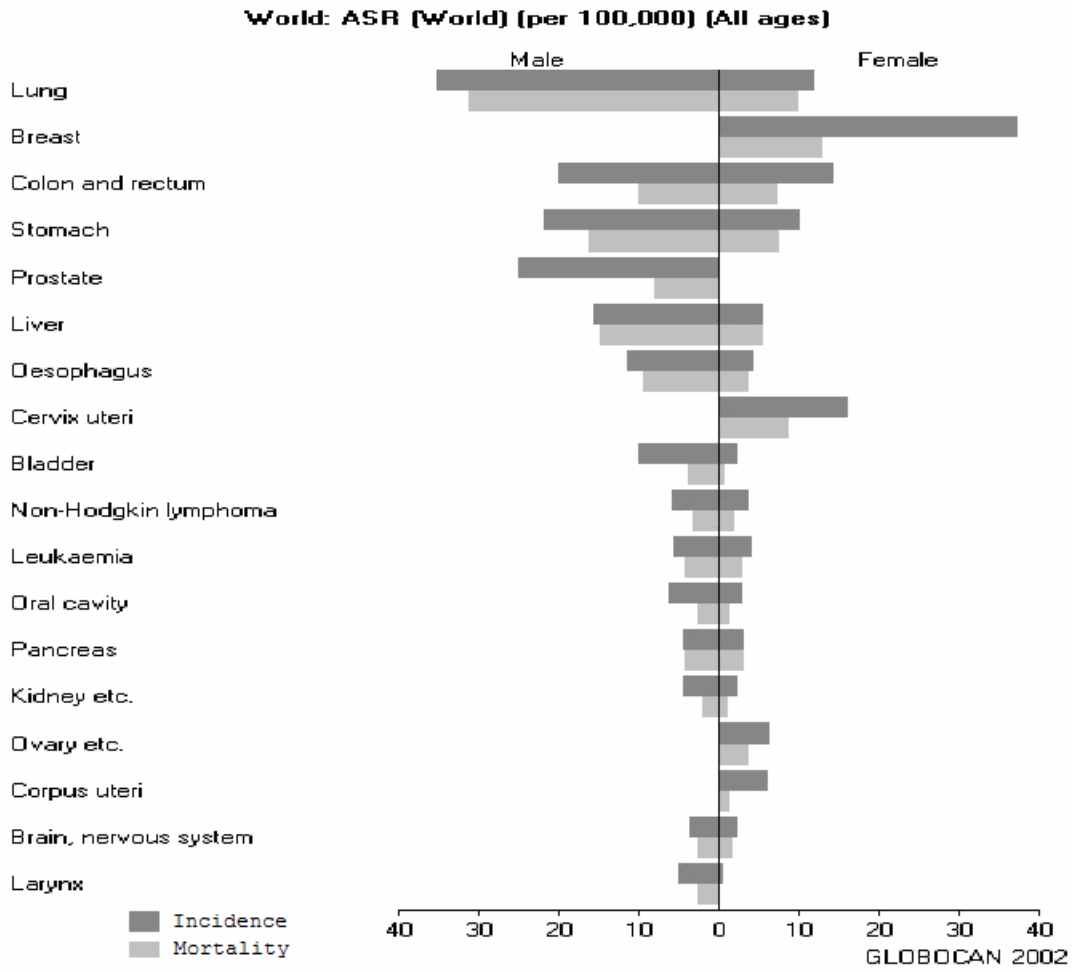

Figure 2. Global cancer incidence and mortality by sex and cancer site

The most noticeable feature of the distribution of cancer between the sexes is the male predominance of lung cancer (Figure 2). Stomach, esophageal and bladder cancers are also much more common in men. Differences in distribution between the sexes are mainly attributable to differences in exposures rather than variation in susceptibility. For other tumor types, including cancers of the colorectum and pancreas, there is less difference in absolute sense between two sexes.

The burden of cancer is distributed unequally between the developing and developed world, with particular cancer types exhibiting different pattern (Figure 3). All of Europe, Japan, Austria, New Zealand and North America are classified here as more developed regions, whilst Africa, Latin America and the Caribbean, Asia (excluding Japan), Micronesia, Polynesia and Melanesia are classified as developing or less developed regions (Stewart and Kleihues 2003, 11).

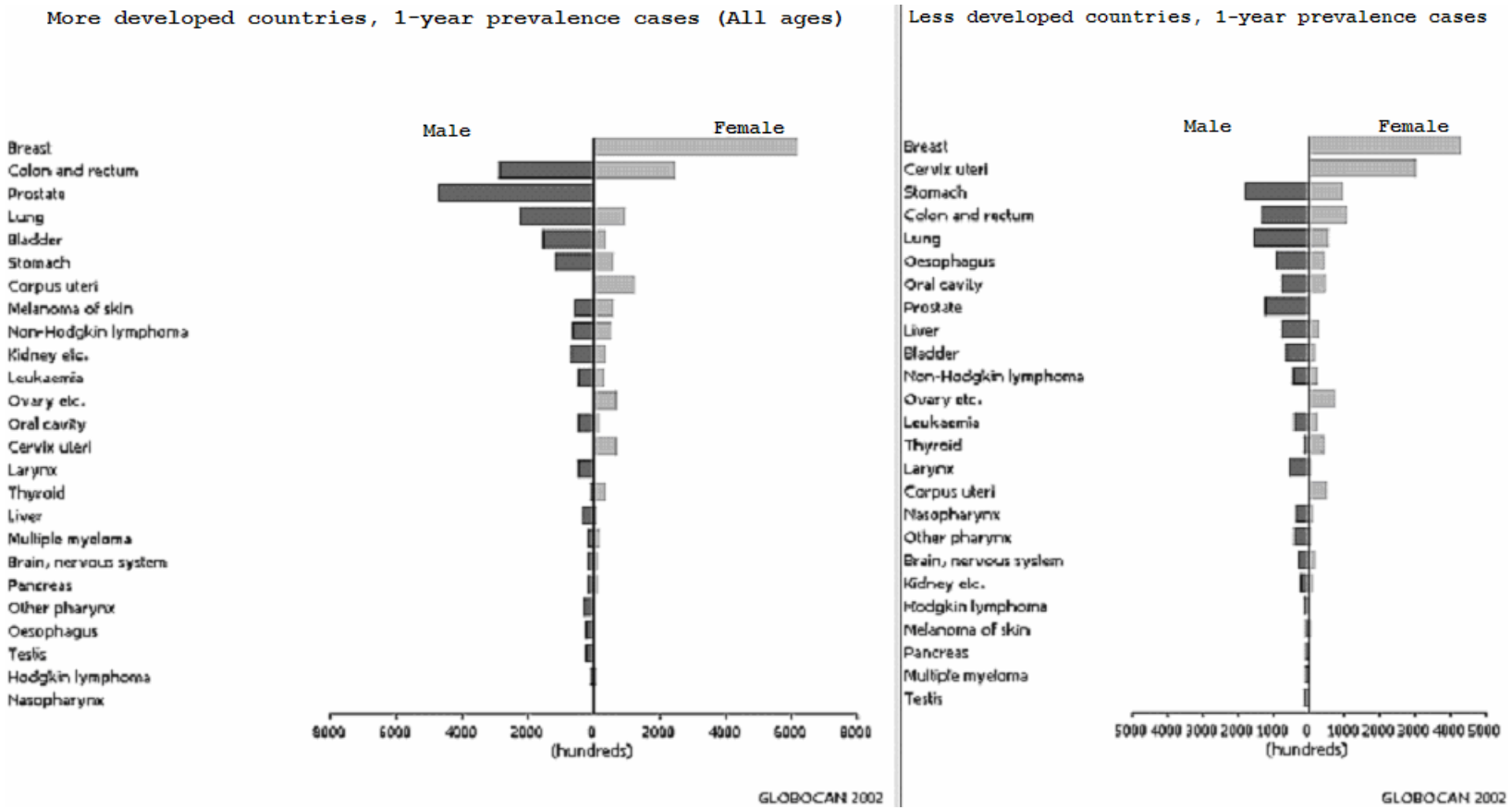

Figure 3. Comparison of the most common cancers in more and less developed countries in 2002

2.1.1.1 Lung cancer

Lung cancer is the most common malignant disease worldwide, and is the major cause of death from cancer, particularly amongst men. It was a rare disease until the beginning of the 20th century. Since then, the occurrence of lung cancer has increased rapidly (Stewart and Kleihues 2003, 182) so that lung cancer has been the most common cancer in the world since 1985 (Parkin et al. 2005) and it now accounts for an estimated 965,000 new cases each year among men and 387,000 among women (Ferlay et al. 2004).

Smoking is the most specific cause of lung cancer (Sela 2000). A causal association with lung cancer has been shown also for consumption of cigars, cigarillos, pipe, bidis, and water pipe (Blot and Fraumeni 1996, 637–665). In men, more than 80% of lung cancer cases are caused by smoking; in women, the attributable risk is less (about 70% in Northern Europe; 45% worldwide) (Stewart and Kleihues 2003, 182). Several other risk factors for lung cancer have been identified. Occupational exposures that increase the risk of lung cancer include asbestos (McDonald and McDonald 1987, 57–59). Asbestos exposure and cigarette smoking act synergistically, together raising the risk of lung cancer multiplicatively (Berry et al. 1985). Other occupational exposures related to lung cancer include arsenic (Blot and Fraumeni 1994, 207–218), chromium (Alderson et al. 1981), polycyclic aromatic hydrocarbons (IARC 1985), and radon. The latter exposure was first discovered among underground miners in North America, Europe, and Asia (Samet 1989), but is now a source of concern for the general population because many household basements show relatively high levels of radon. It is estimated that in the United States, indoor radon may be the second most important risk factor for lung cancer after cigarette smoking (Lubin et al. 1994). Lung cancer is also one of the major effects of exposure to high doses of ionizing radiation, such as in medical and atomic radiation. Various pollutants in urban air are implicated in lung cancer incidence rates worldwide (Blot and Fraumeni 1996, 637–665).

In men, several populations have now passed the peak of the lung cancer epidemic, and incidence rates are now declining (e.g. United States and the countries of Northern and Western Europe). In contrast, incidence and mortality are increasing rapidly in Southern and Eastern European countries. In women, the epidemic is less advanced; most Western countries are still showing a rising trend in incidence and mortality, although in some this is

recent and affecting only recent generations (Spain), while for others (United Kingdom), it seems that the peak of risk may now have been reached. Geographic patterns of lung cancer incidence and mortality are very much influenced by past exposure to tobacco smoking, and the geographic pattern in women reflects the rather different historical patterns of smoking from those in men. The proportion of lung cancer cases due to tobacco smoking can be estimated by comparing observed incidence (or mortality) in different areas with that expected based on rates in nonsmokers from several large cohort studies (Parkin et al. 2005).

The highest incidence rates (>100 cases per 100,000 population per year) are recorded among Afro-Americans from New Orleans, USA and Maoris from New Zealand and are followed by those in the United Kingdom and Netherlands. The lowest incidence rates are reported from Africa and Southern Asia. Rates in women are high in the USA, Canada, Denmark and the UK, but are lower in the countries such as France, Japan, and Spain, in which the prevalence of smoking in women has increased only recently. The lowest rates (< 3 cases per 100,000 population per year) are recorded in Africa and India. In most countries, lung cancer incidence is greater in lower socioeconomic classes; to a large extent, this pattern is explained by differences in the prevalence of smoking. Having risen dramatically since the turn of the century, lung cancer mortality among males is now decreasing in several countries, including the USA, the UK and Finland (Stewart and Kleihues 2003, 182).

Although this cancer is the leading cancer in terms of incidence, its rank in terms of five year prevalence is sixth (5.5% from all sites but skin) (Ferlay et al. 2004) because of low survival rate. Lung cancer remains a highly lethal disease. Survival for 5 years measured by the SEER program in the United States is 15%, the best recorded at the population level. The average survival in Europe is 10%, not much better than the 8.9% observed in developing countries (Parkin et al. 2005).

In brief, lung cancer is the most common tumor worldwide with 965,000 new cases each year among men and 387,000 in women. It is the leading cause of death from cancer. In men, more than 80% of lung cancer cases are caused by smoking; in women, the attributable risk is less (70% in northern Europe, 45% worldwide). Some occupational exposure and air pollution (including environmental tobacco smoke) make a minor contribution to incidence.

2.1.1.2 Breast cancer

Breast cancer is by far the most frequent cancer of women (23% of all cancers) (Parkin et al. 2005) with more than one million cases occurring worldwide annually. Affluent societies carry the greatest risk, with incidence rates of >80 per 100,000 population per year (Stewart and Kleihues 2003, 188). The incidence rate in women worldwide is 37.5 per 100,000 per year (Ferlay et al. 2004).

One in ten of all new cancers diagnosed worldwide each year is a cancer of the female breast, and it is the most common cancer in women in both developing and developed areas. It is also the principal cause of death from cancer among women globally (Bray et al. 2004).

With an estimated 1.15 million new cases in 2002, breast cancer is in second rank overall when both sexes are considered together. More than half of the cases are in industrialized countries about 361,000 in Europe (27.3% of cancers in women) and 230,000 in North America (31.3%). Incidence rates are high in most of the developed areas (except for Japan, where it is third after colorectal and stomach cancers), with the highest age-standardized incidence in North America (99.4 per 100,000). Breast cancer ranks as the fifth cause of death from cancer overall, although still the leading cause of cancer mortality in women (the 411,000 annual deaths represent 14% of female cancer deaths). Incidence rates of breast cancer are increasing in most countries, and the changes are usually greatest where rates were previously low. Since the estimates for 1990, there has been an overall increase in incidence rates of about 0.5% annually. At this rate of growth, there would be around 1.4 million new cases in 2010. However, cancer registries in China are recording annual increases in incidence of 3% to 4%, and in those elsewhere in eastern Asia, increases are not much less. Assuming a 3% growth in East Asia, the world total in 2010 would be 1.5 million (Parkin et al. 2005).

Breast cancer incidence and mortality vary considerably by world region. In general, the incidence is high (greater than 80 per 100,000) in developed regions of the world and low (less than 30 per 100,000), though increasing, in developing regions; the range of mortality rates is much less (approximately 6–23 per 100,000) because of the more favorable survival of breast cancer in (high-incidence) developed regions. The incidence of breast

cancer is increasing almost everywhere. This unfavorable trend is due in part to increases in risk factors (decreased childbearing and breast-feeding, increased exogenous hormone exposure, and detrimental dietary and lifestyle changes, including obesity and less physical activity). On the other hand, mortality is now decreasing in many high-risk countries due to a combination of intensified early detection efforts and the introduction of mammographic screening, resulting in the diagnosis of more small, early stage tumors, and advances in treatment (Parkin and Fernandez 2006).

The Netherlands is an example of the high incidence of breast cancer in developed countries, with an age-standardized incidence rate of 91.6 new cases per 100,000 women-years, but there are sub-populations, such as white women in California, which exhibit age-adjusted incidence rates of 100 or more. Overall, the incidence rate in USA is estimated at 91.4. Such high rates are also observed in Europe, Australia and New Zealand, and in some parts of South America especially Uruguay and Argentina. In contrast, low rates are found among Africa and Asian populations. Amongst population-based cancer registries (as distinct from national estimates) the 30 recording the highest rates include 20 registries from North America, one from South America (Montevideo), two from Israel and five from Europe. Amongst this group, the only one from Africa is for Europeans in Harare. By contrast, among population-based registries with the 30 lowest rates, five are from Africa, 18 from Asia and Israel, three from south America, two from Eastern Europe and two from the United States of America (American Indians in New Mexico and Koreans in Los Angeles, California) (Stewart and Kleihues 2003, 189).

While international variations in the incidence of the disease may implicate a role for environmental factors, available evidence indicates that lifetime estrogen exposure may be a critical factor in breast carcinogenesis. While increasing age and the female sex are well-recognized risk factors, reproductive characteristics such as age at menarche and menopause, menstrual irregularity, age at first and last childbirth, parity and breastfeeding have also been linked to breast carcinogenesis (Okobia and Bunker 2005).

These large geographical differences are potentially justifiable on the basis of genetics or influences of lifestyle and environment. Studies of migrant population have revealed that when women migrate from low-risk to high-risk regions, the migrant populations acquire the rates of the host country after two or three generations, indicating lifestyle as primarily determining the geographic variations in risk (Stewart and Kleihues 2003, 189). In part, the high incidence in the more affluent world areas is likely because of the presence of

screening programs that detect early invasive cancers, some of which would otherwise have been diagnosed later or not at all. The incidence is more modest in Eastern Europe, South America, Southern Africa, and Western Asia, but it is still the most common cancer of women in these geographic regions (Parkin et al. 2005).

The worldwide breast cancer epidemic has many etiological factors, including reproductive history (early menarche, later or no pregnancy), and Western lifestyle (high caloric diet, lack of physical activity) (Stewart and Kleihues 2003, 188). Genetic factors, including the major susceptibility genes (BRCA1, BRCA2), may account for up to 10% of breast cancer cases in developed countries but their prevalence in the population is too low to explain much of the international variation in risk. The majority must therefore be a consequence of different environmental exposures. This is evident from studies of migrants, which show quite clearly that incidence rises following migration from low to high incidence countries, particularly if this takes place at young ages. The major influences on breast cancer risk appear to be certain reproductive factors, body size/obesity, alcohol, physical activity, exogenous hormones (oral contraceptives, hormone replacement therapy), and, possibly, diet. There have, however, been few attempts to quantify the magnitude of risk differentials between populations that might be explained by such factors (Parkin et al. 2005).

In some regions, including North America, Western Europe and Australia, breast cancer mortality rates have started to decline, mainly due to improvements in early detection and treatment (chemotherapy and tamoxifen). Five-year survival rates are higher than 70% in most developed countries. Breast cancer screening trails of mammography have shown that mortality can be reduced by up to 30%. However, there is limited evidence that this can be achieved in population-based country wide screening programs (Stewart and Kleihues 2003, 188).

Because of its high incidence and relatively good prognosis, breast cancer is the most prevalent cancer in the world today by five year prevalence of 17.5% out of all site but skin cancers (Ferlay et al. 2004); there are an estimated 4.4 million women alive who have had breast cancer diagnosed within the last 5 years (compared with just 1.4 million survivors - male or female- from lung cancer). It has been estimated that 1.5% of the US female population are survivors of breast cancer (Parkin et al. 2005).

In brief, breast cancer is the most common malignancy affecting women, with more than one million cases occurring worldwide annually. Wealthy societies carry the greatest risk.

The worldwide breast cancer epidemic has many etiological factors, including reproductive history (early menarche, late or no pregnancy), and western lifestyle (high caloric diet, and lack of physical activity).

2.1.1.3 Stomach cancer

Until recently, stomach cancer was the second most common cancer worldwide, but now, with 933,000 new cases per year in 2002 (8.6% of new cancer cases), it is in fourth place behind cancers of the lung, breast, and colon and rectum (Ferlay et al. 2004). It is the second most common cause of death from cancer (700,000 deaths annually). Almost two-thirds of the cases occur in developing countries and 42% in China alone. The geographical distribution of stomach cancer is characterized by wide international variations; high-risk areas (ASR in men, >20 per 100,000) include East Asia (China, Japan), Eastern Europe, and parts of Central and South America. Incidence rates are low (<10 per 100,000 in men in Southern Asia, North and East Africa, North America, and Australia and New Zealand). Patterns in women are broadly similar to those in men. Although it has been suggested that gastric cancer is rare in Africa, the incidence in Central (Middle) Africa is not very low, with an estimated age-standardized rate in women (12.6 per 100,000) similar to that in Eastern Europe (Parkin et al 2005). The five-year prevalence of stomach cancer constitutes 6% of all sites cancer but skin (Ferlay et al. 2004).

Approximately 60% of all stomach cancers occur in developing countries. There is marked geographical variation in incidence between countries and among different ethnic groups within the same locate. Migration studies show that the risk of cancer changes within two generations when people move from high-incidence to low-incidence areas. For example, Japanese immigrants to the USA retain their original risk of stomach cancer, whereas subsequent generations show the incidence of the host country. Incidence in men is twice that in women in both high and low-risk countries (Stewart and Kleihues 2003, 194).

Survival for stomach cancer is moderately good only in Japan (52%), where mass screening by photofluoroscopy has been practised since the 1960s. Survival is also relatively high in North America (21% based on the SEER data, 40% age-adjusted estimate), possibly due to early diagnosis following a greater number of endoscopic examinations performed for

gastric disorders. Survival is 27% (estimated) in Western Europe while it is as low as 6% in sub-Saharan Africa (Parkin et al. 2005).

The well-differentiated type of adenocarcinoma (which is showing the greatest decrease in incidence) occurs more predominantly in high risk areas, while the diffuse poorly-differentiated type is relatively more frequent in low-risk areas. In contrast to the overall decreasing trend, there has been an increase of cancers localized to the cardia, documented by data from UK and USA, the reasons for this increase are not known. Over the last few decades, a steady decline in the incidence and mortality rates of gastric carcinoma has been observed worldwide and in particular in North America and Western Europe. However, the absolute number of new cases per year is increasing mainly because of ageing of the population. Gastric carcinoma is extremely rare below age 30; thereafter incidence increases rapidly and steadily to reach the highest rates in the oldest age group in both sexes (Stewart and Kleihues 2003, 194).

The principal microbial agent causing cancer is the bacterium *Helicobacter pylori* (5.5% of all cancers) (Parkin 2006). The evidence linking *H. pylori* infection to cancer of the stomach was considered sufficient by IARC to classify this bacterium as carcinogenic in humans. Its action is probably indirect by provoking gastritis, a precursor of gastric atrophy, metaplasia, and dysplasia. Infection is acquired in childhood, and prevalence within populations is certainly related to socioeconomic status. The international variation in its prevalence bears a certain similarity to that of stomach cancer; the overall estimate of *H. pylori* prevalence in adults is 76% in developing countries and 58% in developed countries. However, it is clear that with such high prevalence and relatively small international variation, other factors than *H. pylori* are of major importance. Diet certainly plays an important role. Risk is increased by high intakes of some traditionally preserved salted foods, especially meats and pickles, and with salt per se. Risk is decreased by high intakes of fruits and vegetables, which may be in part related to their vitamin C content. Tobacco smoking is another risk factor which increases the risk of stomach cancer (Parkin et al. 2005).

There has been a steady decline in the risk of gastric cancer incidence and mortality over several decades in most countries. The worldwide estimates of age-adjusted incidence (22.0 per 100,000 in men and 10.3 per 100,000 in women) are about 15% lower than the values estimated in 1985. This decline may be related to improvements in preservation and storage of foods; it may also represent changes in the prevalence of *H. pylori* by birth cohort,

perhaps as a result of reduced transmission in childhood, following a trend for improved hygiene and reduction of crowding. If the observed secular decline continues, the expected number of new cases in 2010 will be around 1.1 million (an increase of 19%), rather than the 21% additional cases due simply to a population growth and aging (Parkin et al. 2005).

In brief, cancer of the stomach is amongst the most common malignancies worldwide, with some 933,000 new cases every year. Infection with *H. pylori* causes chronic atrophic gastritis and is considered a factor in the development of stomach cancer.

2.1.1.4 Colorectal cancer

Colon and rectum cancers accounted for 1,023,256 new cases in 2002 (9.4% of the world total), and unlike most sites, numbers were not so different in men and women (ratio, 1.2:1) (Ferlay et al. 2004). In terms of incidence, colorectal cancers rank fourth in frequency in men and third in women. Survival estimates (in men) at 5 years are 65% in North America, 54% in Western Europe, 34% in Eastern Europe, and 30% in India. The overall relatively good prognosis means that mortality is about one half that of incidence (about 529,000 deaths in 2002), while prevalence is second only to that of breast cancer worldwide, with an estimated 2.8 million persons alive with colorectal cancer diagnosed within 5 years of diagnosis (Parkin et al. 2005). The five year prevalence of this cancer is 11.5% out of all sites cancers but skin and in third rank for both sexes worldwide (Ferlay et al. 2004).

There is at least a 25-fold variation in occurrence of colorectal cancer worldwide. The highest incidence rates are in North America, Australia/New Zealand, Western Europe, and, in men especially, in Japan. Incidence tends to be low in Africa and Asia and intermediate in southern parts of South America. The geographical distribution of colon and rectal cancer is similar, although the variation between countries is more striking for colon cancer. In high-risk populations, the ratio of colon to rectal cancer incidence is 2:1 or more (rather more in females). In low-risk countries, colon and rectal cancer rates are generally of the same magnitude (Parkin et al. 2005).

These large geographic differences for colon and rectal cancers are probably explained by different environmental exposures. There are strong international correlations between risk of large bowel cancers and per capita consumption patterns of meat (Armstrong and Doll

1975), fat (specifically animal fat) (Prentice and Sheppard 1990), and fiber (McKeown-Eyssen 1994). Epidemiologic studies find consistent evidence that physical inactivity, excess body weight, and a central deposition of adiposity have a major influence on risk of colon cancer (Giovannucci 2002). That the risk of colon cancer is quite labile to environmental change is evident from the study of migrants; when populations moved from low-risk to high-risk areas, the incidence of colorectal cancer increases rapidly within the first generation (McMichael et al. 1980; Gelboin et al. 1980, 327–340), implying that dietary and other environmental factors constitute a major component of risk. Japanese individuals born in the United States now have higher rates than those of US Whites (38.4 per 100,000 in men, 27.6 per 100,000 in women), and the rates in Japanese individuals living in Hawaii (51.2 per 100,000 in men, 30.8 per 100,000 in women) and Los Angeles (48.0 per 100,000 in men, 32.8 per 10^5 in women) are among the highest in the world (Parkin et al. 2002).

In general, rates of incidence of colorectal cancer are increasing rather rapidly in countries where overall risk was formerly low (especially in Japan, but also elsewhere in Asia), while in high-risk countries, trends are either gradually increasing, stabilizing (North and West Europe), or declining with time (North America). Such moderations with time have been noted particularly in younger age groups (Parkin et al. 2001).

A major etiological factor is lifestyle involving a diet rich in fat, refined carbohydrates and animal protein, combined with low physical activity. Studies suggest that risk can be reduced by decreasing meat consumption and increasing intake of vegetables and fruit. Sequential genetic alterations mediate development of colon cancer, the earliest such change being mutation of the APC gene. Familial clustering has usually a genetic basis. Typical syndromes include familial adenocarcinomatosis polyposis (FAD) and hereditary non-polyposis colon cancer (HNPCC). Colonoscopy is the most reliable means for early detection. Progressively improved treatment has resulted in a five-year survival rate of about 50% (Stewart and Kleihues 2003, 198).

In brief, cancers of the colon and rectum are rare in developing countries, but are the second most frequent malignancy in affluent societies and over 940,000 cases occur annually worldwide.

2.1.1.5 Prostate cancer

There were 679,100 new cases of prostate cancer worldwide in 2002, making this the fifth most common cancer in the world and the second most common in men (11.7% of new cancer cases overall; 19% in developed countries and 5.3% in developing countries) (Ferlay et al. 2004). The prognosis is relatively good; it is a less prominent cause of mortality with 221,000 deaths (5.8% of cancer deaths in men and 3.3% of all cancer deaths). Three-quarters of all cases are in men aged 65 or more. Incidence rates are now influenced by the diagnosis of latent cancers by screening asymptomatic individuals, so that where this practice is common, the "incidence" may be very high (124.8 per 100,000 in the United States, for example, where it is now by far the most commonly diagnosed cancer in men). Incidence is high also in Northern and Western Europe and Australia/New Zealand.

Survival is significantly better in high-risk countries (ratio of age-standardized rates is 87% in the United States versus 45% in developing countries), but much of this is a consequence of more latent cancer being detected by screening procedures. In fact, the relative survival in the United States in 1995–2000 is reported to be 99% (Ries et al. 2004). As a result, mortality rates are probably a better guide to the risk of invasive prostate cancer in different populations. Mortality rates are high in the Caribbean, Southern and Central Africa, North and West Europe, Australia/New Zealand, and North and South America, and low in Asian populations and North Africa. Variations in mortality rates between China and the United States are 16-fold (almost 80-fold for incidence) (Parkin et al. 2005).

Migrants from low-risk countries to areas of higher risk show quite marked increases in incidence (for example, Japanese living in the United States). Some of this change reflects an elimination of the "diagnostic bias" influencing the international incidence rates, but part is almost certainly due to changes in environment (possibly related to diet). Nevertheless, the interethnic variations in incidence observed in international data are mirrored by ethnic variation in risk within certain countries; for example, the Black population has the highest incidence (and mortality) rates in the United States (Miller et al. 1996), some 70% higher than in Whites, who in turn have rates considerably higher than populations of Asian origin (e.g. Chinese, Japanese, and Korean males). Similarly, in Sao Paulo, Brazil, the risk of prostate cancer in black males was 1.8 times that of white men (95% CI, 1.4–2.3) (Bouchardy et al. 1991). The differences in ethnic-specific risk may be mediated via

population differences in alleles of genes coding for enzymes involved in testosterone metabolism (Shibata and Whittemore 1997).

Until the middle of the 1980s, prostate cancer incidence (and mortality) rates in the United States were gradually increasing, partly due to a genuine increase in risk and partly due to increasing diagnosis of latent, asymptomatic cancers in prostatectomy specimens resulting from the increasing use of transurethral resection of the prostate. With the introduction of prostate-specific antigen (PSA) testing in 1986, there was a huge surge in incidence, especially in localized and regional stage disease, so that recorded rates doubled between 1986 and the peak in 1992 (1993 in Blacks). Since then, incidence rates have declined, although they remain substantially higher than before. Prostate cancer mortality rates in the United States began to fall in 1992 for White men and in 1994 for Black men, and are now substantially lower than the rates in 1986. The recent declines in mortality are a consequence of declines in the incidence of distant stage disease, rather than change in survival, suggesting they are largely the consequence of screening (Parkin et al. 2005).

Hsing et al. reviewed data on international trends in prostate cancer incidence and mortality. As in the United States, they observed the largest increases in incidence in high-risk countries, especially in younger men. This is probably partly the effect of increasing detection following transurethral resection of the prostate and, more recently, due to the use of PSA. But there were also large increases in low-risk countries between 1975 and 1990: 104% in Singapore, China; 84% in Miyagi, Japan; 55% in Hong Kong; and 44% in Shanghai, China. Some of this increase may be due to greater awareness of the disease, and diagnosis of small and latent cancers. But it is also probable that there is a genuine increase in risk occurring. Increases in mortality have also been substantial, although they are generally less marked than for incidence, especially in countries where the incidence rates are relatively high. However, since the 1990s, there have been declines in mortality rates of several developed countries, which may be the result of earlier detection and improved treatment (Parkin et al. 2005).

The average increase in the estimated age-adjusted incidence of prostate cancer worldwide between 1985 and 2002 was around 1.1% annually. As noted above, a fair bit of this was due to the huge surge in the United States (9.5% annual increase between 1985 and 1990). But even if there were no further increase in the United States, a continued increase of this magnitude would mean that there would be almost 900,000 new cases per year by the year 2010 (Parkin et al. 2005).

In brief, there are 679,100 new cases of prostate cancer worldwide every year, making this the fifth most common cancer in the world and the second most common in men. Risk factor includes high caloric intake and low physical activity. Black men have the highest, white men an intermediate risk and Asian men a lower risk. Recorded incidence is increasing in many countries, partly as a result of screening for elevated serum levels of prostate-specific antigen.

2.1.1.6 Esophageal cancer

Esophageal cancer is the eighth most common cancer worldwide, responsible for 462,000 new cases in 2002 (4.2% of the total), and sixth most common cause of death from cancer with 386,000 deaths (5.7% of the total) (Ferlay et al. 2004). Cancer of the esophagus has a very poor survival: 16% of the cases in the United States (Ries et al. 2004) and 10% in Europe (Sant et al. 2003) survive at least five years. Geographic variation in incidence is very striking. Even at the level of world area, a 20-fold variation is observed between high-risk China and low-risk western Africa (Munoz and Day 1996). Other areas of relatively high risk are southern and eastern Africa, south-central Asia, and (in men only) Japan. Esophageal cancer is more common in males in most areas—the sex ratio is 7:1 in Eastern Europe, for example -although in the high-risk areas of Asia and Africa, the sex ratio is much closer to unity (Parkin et al. 2005).

This geographic variability is even more marked when smaller units are studied, for example, between countries or even within countries (e.g. in China, South Africa, or France) (Munoz and Day 1996). It seems that the environmental carcinogens responsible also show important geographic differences. Tobacco and alcohol are the main agents involved in Europe and North America, where over 90% of cases can be attributed to these causes. Chewing of tobacco (and betel) is important in the Indian subcontinent. Hot beverages have been shown to increase risk, and drinking hot mate (tea) is probably responsible for high rates in Uruguay, southern Brazil, and northern Argentina. Nutritional deficiencies (specifically of micronutrients) are thought to underlie the high risk in central Asia, China, and southern Africa. Here other factors such as pickled vegetables, nitrosamine-rich foods, and mycotoxins may also be involved, as well as consumption of opium residues (in Iran) or pipe stem residues (in the Transkei of southern Africa) (Munoz

and Day 1996). On the other hand, genetic predisposition may explain the rather high rates of esophageal cancer in Japan and US Japanese (Miller et al. 1996). Polymorphisms of two genes controlling the alcohol-metabolizing enzymes (Yokoyama et al. 2002), alcohol dehydrogenase 2 (ADH2) and aldehyde dehydrogenase 2, are notably frequent in populations in east and Southeast Asia (Goedde et al. 1992).

Worldwide, most esophageal cancers are squamous cell carcinomas, arising in the middle and low third of the esophagus. Recently, there appears to be an increase in western countries in relative and absolute numbers of adenocarcinomas of the lower third of the esophagus (Vizcaino et al. 2002). Since both histological types are related to alcohol and tobacco smoking, changes in these two exposures cannot explain the differential trends. The most likely explanation for the increases in incidence of adenocarcinoma seems to be the increasing prevalence of Barrett's esophagus as a consequence of gastroesophageal reflux, which is becoming more common with increasing levels of obesity (Chow et al. 1998; Lagergren et al. 1999).

In brief, cancer of the esophagus is the sixth most common cancer worldwide (more than 460,000 cases per year). Squamous cell carcinoma is most common in developing countries and is typically associated with tobacco smoking and alcohol abuse. Other risk factors include consumption of very hot beverages and malnutrition. Adenocarcinoma occurs predominantly in white men from developed countries, the most important etiological factors being obesity and chronic gastroesophageal reflux.

2.1.1.7 *Bladder cancer*

An estimated 357,000 bladder cancer cases occurred in 2002, making this the ninth most common cause of cancer for both sexes combined. It consists 4.5% of survivors of all cancers for five years (five year prevalence) (Ferlay et al. 2004). There were 145,000 deaths, with population-based five-year survival rates ranging from 40% to 80% depending on whether noninvasive lesions are included in the computation. It is relatively common in developed countries, where 63% of all incident cases occur. The majority (77%) of bladder tumors occur in men. The variation in international incidence is not particularly striking relative to other cancers, however. Rates are high in many southern and eastern European countries where smoking (in men) has been prevalent, and in parts of Africa and the

Middle East where bladder cancer, particularly of the squamous cell type, is linked to chronic infection with Schistosoma hematobium (IARC Monograph. 1994). Some occupational exposures contribute to the high risk of developed countries. The highest recorded incidence rate is that found in Egypt, where the estimated world-standardized rate in men is 37 per 100,000. In the United States, the incidence in Whites is higher than in Blacks -about double among men and 50% greater among women. It is unlikely that this is due to differences in exposure to environmental carcinogens, and explanations based on differential susceptibility have been proposed, including, for example, genetic polymorphisms of metabolic enzymes such as N-Acetyltransferase (NAT) and Glutathione S-transferase 1 (GSTM1) (Yu et al. 1994; Yu et al. 1995).

Bladder cancer is primarily attributable to smoking, which accounts for 65% of male and 30% of female cases in some developed countries. Other less important causes include analgesic abuse (phenacetin), some types of cancer chemotherapy and, historically, occupational exposure to chemicals such as 2-naphtahlamine. In Egypt and some Asian regions, chronic cystitis caused by Schistosoma hematobium infection is a major risk factor (Stewart and Kleihues 2003, 228). Treatment based on endoscopy, surgery, radiotherapy and cytotoxic drugs often permits long-term survival in developed countries, where 65% of patients live for at least five years after diagnosis (Stewart and Kleihues 2003, 228).

In brief, around 357,000 bladder cancer cases occur worldwide every year. Smoking is the main known risk factor. Other less important causes include analgesic abuse, some types of cancer chemotherapy and, historically, occupational exposure to chemicals such as 2-naphthylamine.

2.1.1.8 Liver cancer

About 620,000 new cases of liver cancer, usually hepatocellular carcinoma, occur annually, and contribute significantly to cancer mortality worldwide. More than 80% of cases occur in Asia and Africa and irrespective of etiology; the incidence rate is more than twice as high in men as in women (Stewart and Kleihues 2003, 203). Liver cancer is the sixth most common cancer worldwide in terms of numbers of cases (626,000 or 5.7% of new cancer cases) but because of the very poor prognosis, the number of deaths is almost the same (598,000) (Ferlay et al. 2004). It is therefore the third most common cause of death from

cancer. Survival rates are 3% to 5% in cancer registries for the United States and developing countries (Parkin et al. 2005). 82% of cases (and deaths) are in developing countries (55% in China alone). The areas of high incidence are sub-Saharan Africa, eastern and southeastern Asia, and Melanesia. The incidence is low in developed areas (only in southern Europe is there any substantial risk), Latin America, and south central Asia. The overall sex ratio (male: female) is around 2.4, much greater in the high-risk areas and less in low-risk areas (Parkin et al. 2005).

Worldwide, the major risk factors for liver cancer are infection with the hepatitis B and C viruses, both of which increase the risk of liver cancer some 20-fold (Donato et al. 1998). Because hepatitis B virus (HBV) is more prevalent, the distribution of infection worldwide largely explains the patterns of liver cancer. The exception is Japan, where chronic infection with HBV is low, but where the generations most at risk of liver cancer have a relatively high rate of infection with hepatitis C virus (Tanaka et al. 1994). More than 75% of cases worldwide, and 85% of cases in developing countries, are caused by these two viruses (Parkin et al. 1999, 5–33). Exposure to aflatoxin is probably also an important contributor to the high incidence of liver cancer in those tropical areas of the world where contamination of food grains with the fungus Aspergillus fumigatus is common. There is a multiplicative interaction between aflatoxin exposure and chronic HBV infection, suggesting different carcinogenic mechanisms (Parkin et al. 2005).

Cholangiocarcinoma, a tumor of the epithelium of the intrahepatic bile ducts, comprises 10% to 25% of liver cancers in men in Europe and North America, and a much larger proportion in women. The incidence shows little international variation, with rates in males between 0.5 and 2.0, and lower in females (Parkin et al. 1993). However, the incidence is very much higher in some localized areas, where infection with liver flukes is common (e.g. Northeast Thailand) (Parkin et al. 2005).

Primary prevention of the majority of liver cancer cases worldwide is now feasible, thanks to the development of a vaccine against HBV. This has been shown to be effective in preventing infection in childhood. A dramatic demonstration of the results of community vaccination is already available from Taiwan, where HBV immunization of newborns was introduced in 1984; for children aged 6 to 9 years in birth cohorts receiving vaccination, there was a dramatic decrease in incidence of liver cancer (Chang et al. 1997).

In brief, about 620,000 new cases of liver cancer, usually hepatocellular carcinoma, occur annually, and contribute significantly to cancer mortality worldwide. In Africa and Asia, hepatocellular carcinoma is most frequently caused by hepatitis B and C virus infections; concomitant dietary exposure to aflatoxins multiplies the risk. In Western countries, liver cirrhosis due to chronic alcohol abuse is the major etiological factor.

2.1.1.9 Cervical cancer

Cervical cancer is the seventh in frequency overall (Ferlay et al. 2004), but the second most common cancer among women worldwide (Stewart and Kleihues 2003, 215) with an estimated 493,000 new cases and 274,000 deaths in the year 2002 (Ferlay et al. 2004). In general terms, it is much more common in developing countries, where 83% of cases occur and where cervical cancer accounts for 15% of female cancers, with a risk before age 65 of 1.5%. In developed countries, cervical cancer accounts for only 3.6% of new cancers, with a cumulative risk (0 to 64) of 0.8% (Parkin et al. 2005).

The highest incidence rates are observed in sub-Saharan Africa, Melanesia, Latin America and the Caribbean, south-central Asia, and Southeast Asia. Incidence rates are now generally low in developed countries, with age-standardized rates less than 14.5 per 100,000. This pattern is relatively recent, however; before the introduction of screening programs in the 1960s and 1970s, the incidence in most of Europe, North America, and Australia/New Zealand was similar to that in developing countries today (Gustafsson et al. 1997). For example, incidence was 38.0 per 100,000 in the Second National Cancer Survey of the United States (Dorn and Cutler 1959). Very low rates are also observed in China (6.8 per 100,000) and Western Asia (5.8 per 100,000); the lowest recorded rate is 0.4 per 100,000 in Ardebil, northwest Iran (Sadjadi et al. 2003).

Mortality rates are substantially lower than incidence. Worldwide, the ratio of mortality to incidence is 55%. Survival rates vary between regions with quite good prognosis in low-risk regions (74% in SEER and 63% in the European registries). Even in developing countries, where many cases present at relatively advanced stage, survival rates are fair (Parkin et al. 2005).

It is quite clear that the major etiological agents are oncogenic subtypes of the human papilloma virus (HPV) (Bosch et al. 2002). Recent geographic studies using sensitive polymerase chain reaction DNA testing methods to detect a wide spectrum of HPV types have generally observed HPV prevalence to correlate with the population risks of cervical cancer, although it has not always been possible to take into account the relative efficacy of regional screening programs (Munoz et al. 1992; Pham et al. 2002). Other cofactors (e.g. high parity, tobacco smoking, and use of oral contraceptives) probably modify the risk in women infected with HPV (Parkin et al. 2005).

There have been quite substantial declines in cervical cancer incidence and mortality, most clearly observed in Western countries where there are well-developed screening programs. Declines are also evident in some developing countries; this is particularly striking in China, where the estimated age-standardized incidence rate in 2002 was 6.8, compared with 17.8 in 1985. Although some of the difference reflects changing data sources, cancer registry results also indicate a fairly dramatic decline in rates in recent years. As a result of these trends, cervical cancer has ceded its place as the leading cancer in developing countries to breast cancer; only in sub-Saharan Africa, Central America, south-central Asia, and Melanesia is it now the main cancer affecting women (Parkin et al. 2005).

In brief, cervical cancer is the second most common cancer among women worldwide, with an estimated 493,000 new cases and 274,000 deaths every year. Sexually transmitted infection with human papiloma virus is fundamental to the development of carcinoma of the cervix uteri.

2.1.1.10 Non-Hodgkin lymphoma

The 301,000 cases of non-Hodgkin lymphoma (NH lymphoma) that occurred in 2002 (2.8% of all cancers) (Ferlay et al. 2004) comprise an extremely heterogeneous group of malignancies displaying distinct behavioral, prognostic, and epidemiological characteristics. Advances in molecular biology, genetics, and immunology have resulted in extensive changes in the classification of lymphoid tumors in the last few decades. The WHO classification (Jaffe et al. 2001) distinguishes tumors primarily by cell lineage defined by immunophenotype and groups together lymphomas and leukemia, acknowledging that some solid tumors also pass through circulating leukemic phases.

Three broad categories are now recognized: B-cell neoplasms, T/NK-cell neoplasms, and Hodgkin disease. Lymphocytic leukemia falls within the B-cell neoplasm group (Parkin et al. 2005).

NH lymphoma is slightly more common in developed countries (50.5% of cases worldwide), with rates highest in Australia and North America, intermediate in Europe (except Eastern Europe) and the Pacific islands, and relatively low throughout Asia and Eastern Europe. In most African populations, incidence of NH lymphoma is not high overall, but the relative frequency is above the world average in sub-Saharan Africa because of the high incidence of Burkitt lymphoma in children in the tropical zone of Africa. The relatively high estimated incidence in females in central Africa is a consequence of high relative frequency of such cancers in the few available datasets from this area (Parkin et al. 2005).

Approximately 5% to 10% of HIV-infected persons will develop a lymphoma, and NH lymphoma is the AIDS-defining illness in about 3% of HIV-infected patients (Remick et al. 1995). In most parts of the world, B-cell lymphomas tend to dominate, although peripheral T-cell tumors comprise the majority of NH lymphomas in eastern Asia and the Caribbean (Melbye and Trichopoulos 2002). Adult T-cell leukemia/lymphoma (ATL) accounts for a high proportion of NH lymphoma cases in southern Japan (Arisawa et al. 2000).

There have been marked increases in the incidence of NH lymphoma in many parts of the world. While this may in part be due to improved diagnostic procedures and changes in classification, there can be little doubt that much of the change is real (Harge and Devesa 1992) and the reasons for it have been the subject of much debate. The increase is seen in both sexes across Europe since the 1960s. Increases of about 1% to 2% per year in incidence rates in both sexes by period of diagnosis are seen in Australia and, at a lower level, in South America and Asia. In the United States, the rapid rises (particularly in younger men) may be partially attributable to the onset of the AIDS epidemic in 1981, while the declines during the 1990s may be due in part to a decrease in the incidence of HIV infection and successful antiretroviral therapies (Eltorn et al. 2002). AIDS cannot, however, account for all of the observed increases, as subtypes not associated with AIDS are continuing to increase. Other established risk factors, such as those related to disorders of the immune system (e.g. transplant patients, autoimmunity, congenital immunodeficiency), are not likely to explain more than a fraction of the observed incidence. The biological evidence that ultraviolet exposure to sunlight can result in

immune modulation and increased NH lymphoma risk is credible, but results from the epidemiological studies have been so far conflicting (Melbye and Trichopoulos 2002).

Non-Hodgkin lymphoma is increasing worldwide. Advances in chemotherapy have led to a five-year survival rate for non-Hodgkin lymphoma has increased to 60–70 % (Stewart and Kleihues 2003, 237).

In brief, 301,000 cases of non-Hodgkin lymphoma occur worldwide every year, predominantly in more developed countries. Non-Hodgkin lymphoma is the AIDS-defining illness in about 3% of HIV-infected patients. Other established risk factors are those related to disorders of the immune system (e.g. transplant patients, autoimmunity, congenital immunodeficiency) and ultraviolet exposure from sunlight which can result in immune modulation and non-Hodgkin.

2.1.1.11 Leukemia

Leukemia is the eleventh most common cancer worldwide with more than 250,000–300,000 new cases each year. It typically results from malignant transformation of white blood cells or their precursors. Subtypes are identified on the basis of the cell of origin (lymphocytic or myeloid, etc.) and clinical course (acute or chronic) (Stewart and Kleihues 2003, 242).

Leukemia accounts for about 2.8% of all new cancer cases and 222,000 deaths (Ferlay et al. 2004). This rather high ratio of deaths/cases (74%) reflects the poor prognosis of leukemia in many parts of the world, where the somewhat complex treatment regimes required are not available. There is relatively little geographic variation; the range of incidence rates is about five- to sevenfold, with the lowest rates in sub-Saharan Africa (probably representing failure of diagnosis to some extent) and the highest in North America and Australia/New Zealand. The geographic patterns will not be the same for different leukemia subtypes. For example, chronic lymphocytic leukemia (equivalent to small lymphocytic (B-cell) lymphoma in current classifications) is numerically the most important diagnosis in Western Europe, but is extremely rare in east and Southeast Asia. Variations in mortality are significantly less than for incidence, due to better survival (and hence lower mortality)

in developed countries where survival is twice that in developing countries (Parkin et al. 2005).

The etiology of leukemia is largely unknown, although a small proportion of cases is attributable to treatment with anticancer drugs or exposure to ionizing radiation. The genetic characteristics of much leukemia have been elucidated. Treatment of acute leukemia has made much progress and helped to establish general principles of cancer chemotherapy and management (Parkin et al. 2005). Survival varies greatly according to type, with acute lymphoblastic leukemia patients having a five-year survival rate of up to 70%, whilst for those with acute myeloid leukemia it is only 20–30 % (Stewart and Kleihues 2003, 242).

In brief, leukemia is the eleventh most common cancer worldwide with more than 250,000–300,000 new cases each year. The etiology of leukemia is largely unknown although a small proportion of cases is attributable to treatment with anticancer drugs or exposure to ionizing radiation. The genetic characteristics of many leukemias have been elucidated.

2.1.2 Cancer in Iran

Since more than forty years, several groups have tried to assess cancer incidences in different areas of Iran (Mahboubi et al. 1973, Habibi 1965, Nadim and Noorai 2000). Among these, only the Caspian Cancer Registry in the town of Babol, which was established in 1969 by the joint collaboration of the Institute of Public Health Research (IPHR) of Tehran University and the International Agency for Research on Cancer (IARC), Lyon, France, provided a relatively reliable source of data on cancer incidence in the Caspian Littoral of Iran. Although the study area was limited to Caspian coastline (3 provinces of Mazandaran, Golestan and Gilan as well as the district of Ardebil), data published by this registry alarmed the local and national health authorities by documenting one of the highest incidence rates of esophageal cancer in the world in the northeast of the Caspian Littoral, the Turkmen area (Joint Iran and IARC 1977, Cook-Mozaffari et al. 1979). This led to an international effort to search for the risk factors of this disease in this region (Cook-Mozaffari et al. 1979, Salabian 1989, Mosavi-Jarrahi et al. 2001).

According to the statistics by the Iran Ministry of Health, crude cancer mortality rate was 56/100,000 in year 2000 and cancer was the third most common known cause of death in Iran after cardiovascular diseases and accident (Naghavi 2000a, 384). In recent years, a demand for valid cancer incidence data was increasingly expressed, both by the national health officials and researchers in the field of cancer. Unfortunately, there is no accurate and up-to-date information about cancer incidence available in Iran. Therefore, to assess the cancer incidence in Iran, this investigation in five provinces seems clearly justified.

2.1.2.1 Esophageal cancer

Iran is located in the central Asian esophageal cancer belt (Kmet and Mahboubi, 1972). Westward from the high incidence area in northern Sinkiang, areas of extremely high incidence are seen in the Republics of Kazakhstan, Uzbekistan, and Turkmenistan, in the northeast of Iran and northern Afghanistan (Schottenfeld and Fraumeni 1996, 683). This belt passes the northern part of Iran especially southern coast of Caspian Sea which contains most of the areas of this study as well.

The Babol cancer registry showed that from June 1968 to June 1971 the age-adjusted incidence rates of esophageal cancer for both men and women from Golestan Province who lived in the steppe grasslands of the Turkmen plain and neighboring hills in the north-eastern part of the province were higher than 100/100,000 and thus among the highest rates in the world (Kmet and Mahboubi 1972, Mahboubi et al. 1973). The cancer registry also showed sharp gradients of incidence in a relatively small geographical area. Rates fell westward for some 300 km along the southern Caspian Littoral (a densely populated area inhabited largely by Persians) through Mazandaran Province and into Gilan Province where the incidence was lower than 10 per 100,000 in women and between 10 and 20 per 100,000 for men.

In Western countries esophageal cancer has been mainly a disease of men who smoke and drink alcohol heavily (Munoz and Day 1996, Brown et al. 2001), whereas in the very high incidence areas of Golestan Province (inhabited almost entirely by Turkmen) there were very low rates of smoking and drinking and esophageal cancer was slightly more common in women than in men. Ecological and nutritional studies conducted by IARC and IPHR to establish the epidemiologic features and to investigate the etiology of esophageal cancer

throughout the Caspian Littoral including Golestan Province (Joint Iran and IARC, 1977) found geographical associations of incidence with a number of variables. A subsequent case-control study investigated these associations further and established some risk factors, especially poverty and a restricted diet very low in fresh fruit and vegetables (Cook-Mozaffari et al. 1979), factors that have since been shown to be associated with an elevated risk for esophageal cancer in almost all countries where diet has been studied (Munoz and Day 1996), but it found no clear evidence for other potential risk factors such as hot tea or nass consumption. However, the studies in Iran were discontinued due to the sociopolitical changes there in 1979, before the complete patterns of incidence and the full complement of risk factor results could be established. Some of the major questions that were left unanswered were the precise incidence of esophageal cancer and gastric cancer and the proportions of different histologic subtypes of esophageal tumors in the different ethnicities in Golestan Province, partly because population data by ethnic group were not available and partly because the lack of endoscopy and histological diagnoses may have led to incorrect designation of tumor location and histology for a proportion of patients. It was postulated at the time that almost all the esophageal cancer cases in this area were of squamous origin, but 98% of the tumors were diagnosed by radiology or by clinical methods alone and only 2% had histological confirmation (Mahboubi et al. 1973).

The results of a recent study show that esophageal squamous cell carcinoma (ESCC) is still the predominant type of upper gastrointestinal (GI) cancer in high-risk areas of Golestan Province, and that tobacco, nass, alcohol and perhaps opium consumption are not the major etiological factors for ESCC in this area. ESCC seems to be distributed among both Turkmen and non-Turkmen, and among both city and village dwellers. Therefore, it is likely that the main etiologic factors for the high incidence of ESCC are factors that are shared by most inhabitants of this area. Further case–control and cohort studies are needed to explore the risk factors associated in this region with the very high rates of ESCC (Islami et al. 2004).

2.1.2.2 Stomach cancer

Both frequency and incident data from previous studies in 1970s and 1980s showed stomach cancer as the second common cancer in Iran (Parkin 1986, Mahboubi et al. 1973). A recent cancer surveillance study performed by the Ministry of Health of Iran revealed

that gastric adenocarcinoma is the most common fatal cancer in Iran with a wide variation of death rate in southern Iran (Persian Gulf Coast) 3.6 per 100,000 per year as compared to a rate of 8.4 per 100,000 in East Azarbaijan, northern Iran (Ministry of Health and Medical Education 2000). Of each 100 persons who die of cancer every day in Iran, 22 persons die from gastric (stomach) cancer, 13 from lung cancer, 9 from blood cancer, 8 from liver and biliary cancer, 7 from cancer of the central nervous system and 6 from esophageal cancer (Naghavi 2000b, 377).

2.1.2.3 Other cancers

Information on incidence of other cancers for the recent years is not available, but some data from more than three decades ago will be presented in Section 6.4.1.

3. Aims of the study

The overall objective of this study was to identify the cancer incidence in Iran. To achieve this aim, several specific aims were set such as:

1. To assess data quality
2. To determine incidence rate (crude rate, age-standardized rate and 5 year age-specific incidence rates) of 10 leading cancers in five provinces of Ardebil, Gilan, Mazandaran, Golestan and Kerman each by sex
3. To estimate cancer profile in the whole country of Iran
4. To assess the time trend of incidence rates of 10 leading cancers in Iran
5. To predict cancer burden in Iran in terms of number of cases in the year 2010
6. To compare main results with the incidence estimates of GLOBOCAN 2000 and 2002 for cancer in Iran as well as with those of neighboring areas
7. To develop and test a new method to adjust for ascertainment bias in the evaluation of cancer registry data

4. Material and methods

4.1 Study area

All residents of five provinces of Iran including Ardebil, Gilan, Mazandaran, Golestan, and Kerman constitute the population at risk for the cancer registration in this study. Four of these provinces are located in the north of Iran named Caspian Littoral and the fifth (Kerman) in the south central part of Iran (Figure 4). The northern areas have been selected because cancer incidence in those areas has been recorded 30 years ago for comparison and had high incidence of some cancers. Kerman also has a homogenous population with different lifestyle. Information from the latter province would be suitable to be compared with those of northern ones to make hypotheses about cancer etiology in Iran.

Figure 4. Map of Iran, study area

4.2 Population characteristics

4.2.1 Demographic indicators of Iran

Based on a World Health Organization report, the Islamic Republic of Iran, with a surface area of 1,648,000 km^2, is a highly diverse country, not only in its ethnic variety, but also in topography and climate. Tehran is the capital city and the official language is Farsi (Persian). The population in 1994 was officially estimated at 59.6 million; in 1996 it was 60.1 million and is now estimated at around 70 million. The population is relatively young, with 39.5% below the age of 15 years (Figure 5). In 1996, 4.3% of the population was aged above 65 years. In 1996, 61.3% of the population resided in urban areas (Iran census 1996). The literacy rate for the population 10 years of age and above was 80% in 1996, and the female literacy rate for the population 10 years of age and above was 74.2% in 1996. Twenty seven percent of people above the age of ten are economically active. The per capita income in 1997 was US$ 2118. The majority of the population is Shi'a Muslim. Although the reduction of the population growth rate was ratified as official policy of the government in 1988, the crude birth rate still remains high at 18.7 per 1000 population. The crude death rate was estimated at 4.2 per 1000 population, the infant mortality rate was estimated at 32 per 1000 live births (2004) and the under-5 mortality rate was 33 per 1000 live births. Life expectancy at birth was calculated to be 68–72 years in 2004. Maternal mortality was estimated at 7.6 per 10,000 live births in 2000 (WHO website).

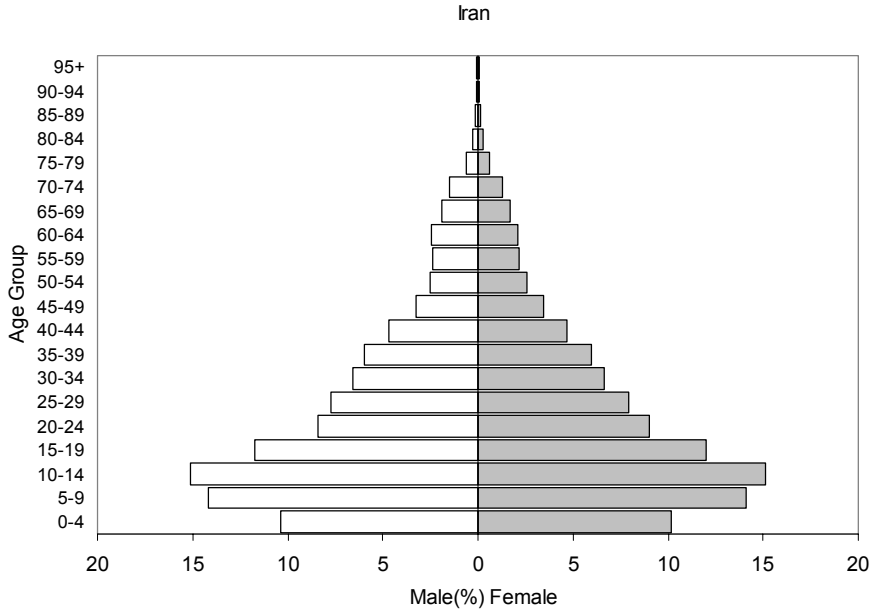

Figure 5. Population pyramid of Iran, census 1996

4.2.2 Five provinces

Geographically, four provinces of Ardebil, Gilan, Mazandaran and Golestan are located in the north of Iran and form southern coast of Caspian Sea. Kerman is located in south of Iran and different climate than others in the north. Kerman has higher urban proportion especially in younger ages compared to other four provinces. In contrast, Golestan has the highest rural proportion in comparison with others (Table 3). The population pyramid for each these provinces is very similar to that of Iran (Appendix Figure 1, Appendix Figure 2, Appendix Figure 3, Appendix Figure 4 and Appendix Figure 5).

Table 3. Demographic indicators of Iran and five provinces, census 1996

		Province					Iran
		Ardebil	**Gilan**	**Mazandaran**	**Golestan**	**Kerman**	
Population	(N)	1,128,864	2,241,896	2,602,008	1,426,288	2,004,328	60,055,488
	(%)	1.9	3.7	4.3	2.4	3.3	100
Area (km^2)	(N)	17,953	13,952	23,833	20,380	181,714	1,648,000
	(%)	1.1	0.8	1.4	1.2	11.0	100
Urban	(%)	46.0	46.8	46.0	41.3	52.9	61.3

4.2.3 Ardebil province

Ardebil was previously a district of East Azerbaijan Province, but became a separate province in 1998. It is located in northwest Iran, an area 50 km inland from the western Caspian coastline, with an area of about 1.09% of the total area of Iran. The province is mountainous with an altitude up to 4,811 m above sea level. The weather is moderate, with cold winters and mild summers.

The total population of Ardebil Province, according to the 1996 census, was 1.1 million (1.94% of Iran's total population), with 46% living in 9 cities and 54% in rural areas. The population is ethnically homogeneous, 95% being from the Azeri background of Aryan Caucasoid ancestry. They speak Azeri, which is a variant of the Turkish language. Consanguinity is common in both urban and rural areas (Sadjadi et al. 2003).

4.2.4 Gilan province

Covering an area of 13,952 square kilometers, Gilan province is located in the north of Iran, stretching between the Alborz and Talesh Mountain Ranges. Rasht is the provincial capital. Gilan province, shares borders with the provinces of Ardebil on the west, Mazandaran on the east, Zanjan to the south and the Caspian Sea and the Republic of Azarbayjan to the north. Gilan has a humid temperate climate with plenty of annual rainfall. Large parts of the province are mountainous, green and forested. Stretching from the east to west are the mountainous regions of Talesh, Masooleh, Poshtkooh as well as the Alborz Mountain Ranges. The plains of the province extend between the mountainous areas and the sea, reaching an altitude of 100 m above sea level.

In the year 1996, this province had a population of 2.2 million, of which 46.8% were registered as urban and 53.2% as rural. Gilan is the most densely populated province in Iran after the Tehran province. Fifty four percent of people in Gilan are under 25 years old. The majority of the population speaks Gilaki (a Persian dialect) as their first language while many children, particularly in the cities, tend to use Standard Persian amongst themselves.

4.2.5 Mazandaran province

Mazandaran province covers an area of 23,833 sq. km. The city of Sary is the center of Mazandaran province. Mazandaran (Khazar) Sea or the Caspian Sea is to the north, the provinces of Tehran and Semnan lie towards the south. Geographically, Mazandaran province is divided into coastal plain and the mountainous area. To the west it has common borders with the Gilan province, and to the east stands the province of Golestan. The province enjoys a moderate, semitropical climate. Mazandarani or Tabari is an Iranian language of the northwestern branch, another Persian dialect spoken in Mazandaran.

According to the census of 1996, the population of the province was 2.6 million of which 46% were urban and 54% rural. Young people under age 25 constitute 56.3% of Mazandaran population.

4.2.6 Golestan province

The province of Golestan with an area of 20,380 square km is in the southeast of the Caspian Sea. Golestan province is divided into the plain and mountainous parts. Gorgan city used to be a part of Mazandaran until recently, but is now the capital city of the new Iranian province of Golestan (since 1997). The Turkaman minority reside in the north of the province, particularly in the cities of Gonbad and Bandar Turkaman. Other minority communities such as Afghans and Armenians also reside in this area, and have preserved their traditions and rituals. Their main language is Persian but minorities speak their own language among themselves.

The population of the province was 1.4 million in 1996, of which 41.3% were urban. Sixty two percent of the Golestan population are younger than 25.

4.2.7 Kerman province

The province of Kerman covers an area of 181,714 sq. km. and is located in the south east of Iran. The said province is the second largest after Khorassan, and includes 11% of the total area of the country. The climate in the province varies in different regions. The north, northwest, and central areas experience a dry and moderate climate, whereas in the south and southeast, the weather is warm and relatively humid. The main language of Kerman is Persian.

In the year 1996, the province of Kerman had a population of 2 million of which 52.9% in the urban areas, and 46% in the rural, the remaining 1.1% counted as non residents. The city of Kerman is the provincial capital, and embraces about 80% of the urban population, being one of the most developed and largest cities of the province. Sixty three percent of Kerman population are younger than 25.

4.3 Case definition and data sources

All the new cancer patients (incident cases) resident in the five provinces of Ardebil, Gilan, Mazandaran, Golestan and Kerman diagnosed for the first time between 1996 and 2000 who are registered with the Cancer Registry (based on the standards of cancer registry) are included in this study (Ardebil Province is an exception with 4 years 1996 to 1999). They had to have ICD-O behavior code 3 (malignant) or 2 (*in situ*) to be eligible to be included in the study. Benign tumor cases were not included in our dataset. Cancer patients with metastasis and unknown origin were not recorded in the database because it was impossible to find out their site of origin and classify them into certain tumor sites. So, metastatic cases were not informative for estimating incidence of each cancer site. Therefore, all diagnosed cases based on pathologic, radiologic confirmation, death certificate and clinical reports are included if they are resident in these five provinces and meet cancer registry criteria for registration. The study protocol has been approved by the Ethic Committee of Digestive Disease Research Center, Tehran University of Medical University of Medical Sciences (Figure 6).

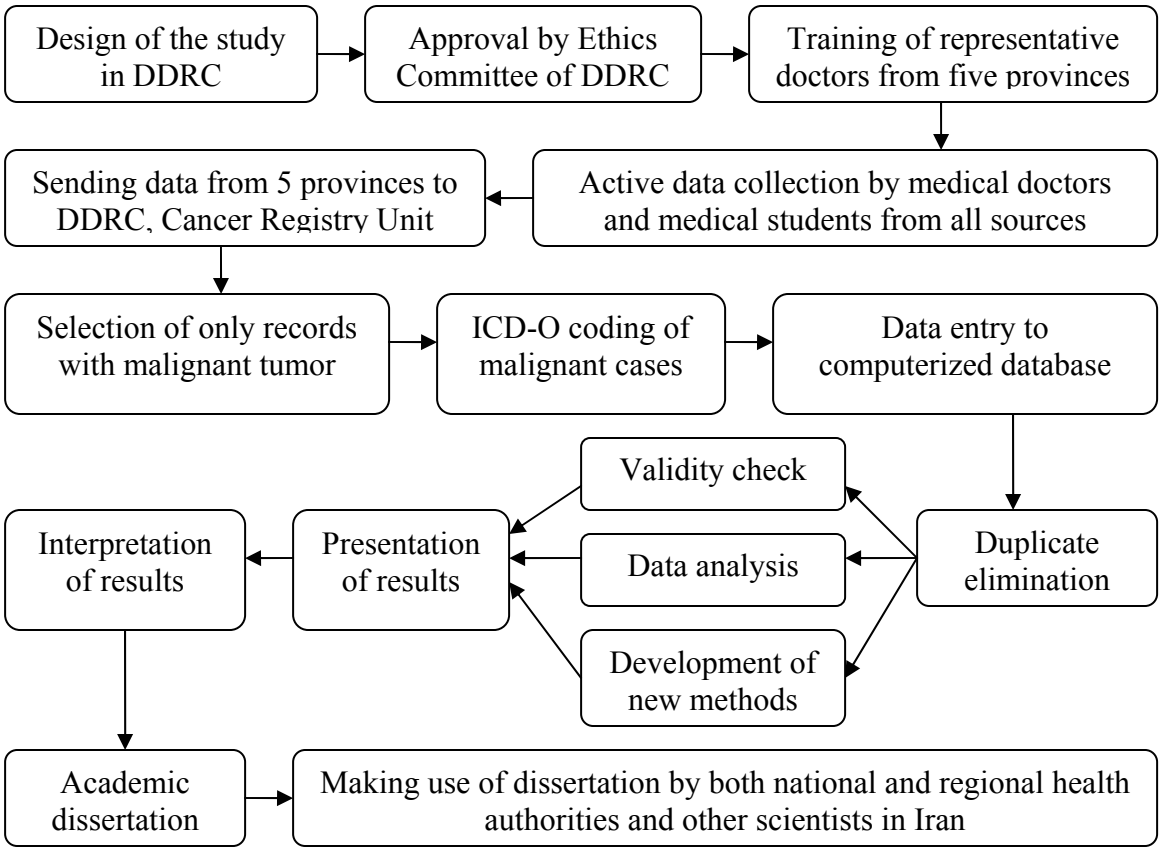

Figure 6. Flow chart of this study (DDRC=Digestive Disease Research Center in Tehran)

This registry unit has started the first population-based cancer registry in Iran and covered these provinces with 15.7% of Iran population (9.4 million out of 60.1 million people, national census 1996). Information about migration during these study years was not available. This unit was collecting all reports from pathology, radiology, laboratory, clinics as well as death certificates. Information about death certificates has been obtained from graveyards which were mainly from urban areas since death registration in rural areas was less complete. Fortunately, cases from rural areas can use primary health care facilities free of charge and there is a referral system which allows them to seek for diagnosis in urban health centers easily. Therefore, it has been assumed that although information about diagnosis of cancer was not available for rural residents in rural primary health care facilities, their information could be found in the upper levels of health care facilities (such as hospitals and pathology laboratories) in urban areas instead.

The registry unit at DDRC consists of a gastroenterologist, epidemiologist, pathologist, and the survey team in each province consists of 5 general practitioners and 10 medical students. Five representative medical doctors from five provinces were selected, and trained by the central cancer registry unit in DDRC. The same instruction was given to them by one person in Farsi language (The only official language of Iran routinely used in all provinces). Each representative trained two medical students as their assistants. The data survey team collected the data from hospitals, pathology laboratories, diagnostic radiology clinics, and outpatient public and private clinics by checking all their records for reports of tumor cases and making one copy of documents according to which a diagnosis of cancer has been made and sent them to the Cancer Registry Unit in DDRC.

During a period of 6 months from January to July 2001, the collectors actively collected and compiled data for a period of 5 years (1996–2000) from all the hospitals, most of the outpatient clinics, all oncologists' private offices, all pathology laboratories, majority of the radiology clinics and central death registry offices in each province. Therefore, all pathology laboratories were included and a copy of the pathological reports was sent to the registry unit.

The private radiology centers recorded the identifying data of subjects; and only occasionally they kept the reports of radiological or sonographic diagnosis of the patients. In public centers usually located in the hospitals, the radiology diagnosis reports were present for the majority of subjects. There was a good endoscopic reporting system in both the public and private hospitals.

A minority of residents of Ardebil seeks better medical care outside their province, mainly in Tabriz (a large city near Ardebil) or Tehran. A thorough search was done for the records of these residents with a diagnosis of cancer in 5 major hospitals and 3 major pathology laboratories of Tabriz. Residence of other four provinces may seek more advanced medical care in Tehran as well. The hospital-based cancer registry of the Cancer Institute, Tehran, currently provides the most reliable and comprehensive data in this large city. All the incident cancer cases from these five provinces, recorded in Tabriz or the Cancer Institute of Tehran were also included for the same period of time (1996–2000).

The effort was to obtain the information about diagnoses of cancer based on microscopic verification (see data specifications) but other sources of data were used whenever the pathologic reports were not available. Therefore, cancer registry recorded every cancer

diagnosis by any method but mentioned the means of diagnosis for each case. As the registry uses several sources, several reports may be found for one case from radiology, pathology, endoscopy etc. so, duplicates were detected by special cancer registry software designed supporting Farsi scripts. Elimination of duplicate records was done based on similar first names and family names and some other available variables such as father's name, age, province, city, means of diagnosis, site of tumor and morphology code.

Certain rules were used to ease the duplicate finding process, first, patients with the same first name and surname are different if they have different cancer site (exceptions are defined in Table 24 of ICD-O_{III} book by Fritz et al. 2000), different father's name, different province, different city other than central city of each province (patients from small cities of each province could be found in the central city of province but not in other cities of the same province) and if they have more than 5 years difference in age at diagnosis. In case of duplicate records, the most reliable source of diagnosis (microscopically verified) were kept and other information in that record were completed from other records of the same person if any part like age or city was missing. Also, the more specific site of tumor was kept, for instance if there were two records for one person, one with site of tumor middle third of esophagus and the other one only esophagus (NOS, not otherwise specified), only the more specific code (lower topography code e.g. 15.2 rather than 15.9) was kept for the final analysis. Regarding morphology, higher number for morphology code was supposed to be the more specific one and was kept.

4.4 Data analysis

The obtained data were summarized in a data sheet and coded using the ICD-O, 3rd edition (Fritz et al. 2000). Information about population at risk for this study was available at the website of Statistical Center of Iran which was based on the last comprehensive census 1996 (a national census is carried out every 10 years).

Since the data were computerized, they were analyzed using SPSS software for descriptive purposes. A programmed sheet in Microsoft Excel was designed to calculate age-specific incidence rates, relative frequencies and ASRs with 95% confidence interval as well as cumulative incidence rates**.** Persian (Farsi) fonts were used in the database because transliteration (using English fonts for Persian names) is problematic since Persian names

can be transliterated in several different ways in English but they just are spelled in one unique way in Persian. Therefore, duplicate elimination was possible only with the Persian names.

4.4.1 Relative frequency and incidence rate

The term "relative frequency" used in this dissertation refers to the proportional frequency of each cancer site to the total of all sites excluding ICD-O code C44 (Other skin). Results presented as the incidence of cancers by site (ICD-O, 3rd edition), sex, age, crude, age-specific and age-standardized rates (ASR) per 100,000 person-years, using direct method of standardization to the world population (Jensen et al. 1991, 131). In incomplete cancer registries a decline in the incidence rate can be seen at the older ages is mainly due to under-registration of very old cases. In this study, an attempt was made to correct this problem. Correction was carried out based on Finnish female age-specific rate coefficient for age older than 79 (using Finnish pattern for "All sites"):

Equation 1

Corrected Rate for age 80 to 84 = $CR_{80–84} = 0.645083^{*} \times (R_{70–74}+R_{75–79})^{**}$

Corrected Rate for age 85 and older = $CR_{85+} = 0.616322^{***} \times (R_{75–79}^{**}+ CR_{80–84})$.

* This is the coefficient calculated by rate of "All site" Finnish female cancers in age group 80-84 divided by summation of Finnish rates of age 70-74 and 75-79

** These are age-specific rates of this study

*** This is the coefficient calculated by dividing rate of "All site" female Finnish cancers in age group "85+" by summation of Finnish rates of age 75-79 and 80-84.

In this dissertation, the cumulative rates were also calculated and adjusted to account for the *cases of unknown age* exactly the same way as age-standardized rate that was explained in section 1.1.1.6 (Parkin et al. 2002, 88).

4.4.2 Corrected incidence trends

In general, using time trend analysis for ASR for such data (with doubt about completeness in first years of registration) was not very informative and the results were not easy to

interpret. To tackle this issue, time trend of relative age-standardized ratio (RASR) was used which seemed to be a better tool. For this novel method, leukemia was chosen as reference cancer with proven constant ASR during long period time. ASR of this cancer was constant during 50 years of registration in the Finnish Cancer Registry (Appendix Figure 1) similar to other valid registries such as SEER in USA (0% change from 1975–2001). Then relative age-standardized ratio was calculated for each cancer (ASR of each cancer compared to ASR of leukemia). For instance, RASR of stomach cancer is calculated as ASR of stomach divided by ASR of leukemia. Similarly for esophageal cancer in men in year 1996, $RASR_{esophageal1996men} = ASR_{esophageal1996men} / ASR_{leukemia1996men}$. Therefore, plotting RASR of each cancer against calendar year was used for trend analysis. Five points were in the plot for each cancer for years 1996 to 2000, so with fitting a linear regression line for these five points, this line showed the change of RASR over time (years of study) which could reflect change in ASR.

The slope coefficient regression line was the change in RASR in one year which reflected slope of change in ASR per one year although the amount of slope was not exactly the same as ASR. In order to correct for the difference in scale of ASR with RASR, the RASR for each year and each cancer was multiplied by sum of ASRs of the same cancer for those years divided by the sum of RASRs of the same cancer for those years. For example, instead of plotting RASRs of rectal cancer, one should plot ARASRs of rectal cancer over time. ARASR of rectal cancer for year 1997 ($ARASR_{rectal1997}$) were calculated as follow: $ARASR_{rectal1997} = RASR_{rectal1997} \times (ASR_{rectal1996} + ASR_{rectal1997} + ASR_{rectal1998} + ASR_{rectal1999} + ASR_{rectal2000}) / (RASR_{rectal1996} + RASR_{rectal1997} + RASR_{rectal1998} + RASR_{rectal1999} + RASR_{rectal2000})$. The empirical data showed that the slope for time trend of ARASR was almost the same as ASR in complete registries (Appendix Figure 7 and Appendix Figure 8). Therefore, it supported the theory that trend of RASR over time reflects trend of ASR. Although results of trend by ARASR and ASR are similar in complete registries, they might be different in incomplete registries so that the extent of difference is hypothesized to be associated with the extent of incompleteness in the registry; thus, the hypothesis is trends by ARASR are more reliable than by ASR in the incomplete cancer registry data.

The general formula for calculating RASR and ARASR are as follows (Appendix Table 27), where *"C_i"* is the cancer site (C_1 to C_n) and *"y"* is the calendar year (1 to k):

Equation 2. Relative age-standardized ratio

$$RASR_{C_i\_y} = ASR_{C_i\_y} / ASR_{Leukemia\_y}$$

Equation 3. Adjusted relative age-standardized rate

$$ARASR_{C_i\_y} = RASR_{C_i\_y} \times \sum_{y=1}^{k} ASR_{C_i\_y} \Big/ \sum_{y=1}^{k} RASR_{C_i\_y}$$

4.4.3 Projection

A projection also was made to estimate the number of new cancer cases in Iran in the year 2010 based on the results of this study. For this purpose, once an assumption was made that there will be no change in the risk factors of cancers during these 15 years (1996–2010), so incidence rate will not change during this period. Then the number of new cancer cases will only be dependent on population (both age structure and number of people). The larger the proportion of elderly people in the population, the more cancer cases will occur, because risk of cancer is age-dependent. Based on prediction made by demographists using trends in previous years, life expectancy of Iranian population is increasing during this 15-year period then proportion of elderly people will increase.

To make the projection for the year 2010, crude incidence rates of these five provinces were adjusted for age structure of Iran population in 2010 (as predicted by the United Nations). Adjustment was done similar to the direct method of standardization, but the standard population was substituted by predicted population of Iran in 2010. So the age-specific rates of this study were multiplied by the corresponding weight from the proportion of population in each age groups in 2010. Multiplying this age-adjusted incidence rate by projected number of people at risk in 2010 results in the number of new cancer cases in 2010. Using age-adjusted incidence rate for each cancer and multiplying it by population in 2010 gives the number of new cases of that particular cancer in 2010 without allowing for the change in incidence during this projection period.

Another estimate was number of new cases in 2010 accounting for the change in incidence. The slope of time trend in adjusted relative age-standardized rates (ARASR) during 5 years of study (1996–2000) was used as the base for the change in incidence rates. Then the

yearly change (increase as positive and decrease as negative) in ARASR for 12 years (average of 1996–2000, 1998, until 2010) was added to the adjusted incidence rate for age structure of Iran population in 2010. For instance, if crude rate of a cancer in 1998 was 9, its calculated age-adjusted rate for 2010 was "10" (as explained in previous paragraph) and its ARASR was decreasing annually 0.2 unit, then the final incidence rate in 2010 will be [10+(12×(-0.2))] which is equal to "7.6". The final predicted number of new cancer cases in 2010 was then calculated by multiplying the predicted final incidence rate by population of Iran in 2010. The method of calculating relative age-standardized ratios (RASR) and relative age-standardized rates (ARASR) are in detail explained in Section 4.4.2.

4.4.4 Confidence interval

Confidence interval for age-standardized rate was calculated by the Poisson approximation method for estimating standard error of ASR (Jensen et al. 1991, 138). Confidence interval for cumulative rate was also estimated by calculation of standard error of cumulative rate which could be derived from expressions for the variance and standard error of a directly adjusted rate using appropriate weights (i.e., the length of the age interval) and the Poisson approximation (Jensen et al. 1991, 149). Confidence interval for the slope of time trend analysis (the average annual change in ASR) was calculated using standard error of coefficient in linear regression analysis (Jensen et al. 1991, 141).

5. Results

5.1 Demographic characteristics

During the five years of study, there were 28,022 new cancer cases. Of them, 56.9% were among men and 41.9% women (sex was unknown for 1.2% of cases). Likewise, age at diagnosis had been recorded for 93.3% of cases. The mean age at diagnosis was 54.88 (95% CI 54.75 – 55.01). Numbers of cases and person-years by province and age group, sex and site are presented in the appendices (Appendix Table 1, Appendix Table 2 and Appendix Table 3).

Table 4. Number of cancer cases by province and year of diagnosis

	Year						
Province	1996	1997	1998	1999	2000	Unknown	Total
Kerman	900	1095	1085	1271	971	95	5417
Mazandaran	779	661	684	973	1338	3868	8303
Gilan	807	821	1364	1340	1443	1850	7625
Golestan	599	631	521	545	679	125	3100
Ardebil	-	-	-	-	-	3510	3510
Unknown	2	4	10	16	13	22	67
Total	3088	3219	3668	4178	4454	9415	28022

5.2 Data quality and internal validity

The majority of cancer cases had been verified microscopically (MV=83.7%). Death certificate only (DCO) cases constituted only 0.1% of cases. About 12.7% of cases were diagnosed clinically only. Only 0.2% of cases had unknown province of residence although it was certain that they were not from outside these five provinces (Table 4). The city of residence was less complete, with 50.9% unknown city. Year of diagnosis had been recorded only for 76% of cases from four provinces of Gilan, Mazandaran, Golestan and Kerman, but there were no dates of diagnosis available for Ardebil (date of birth was not recorded so it was not possible to calculate year of diagnosis by birth year and age at diagnosis).

A few cases (125 cases out of 28,022 or 0.45%) had unlikely age/site combinations (73 cases), unlikely age/histology combinations (42 cases), or wrong or unlikely sex/histology combinations (10 cases). None of them were corrected in the analysis because information was not available to determine which part of these mismatches (age/site/sex/histology) was wrong. In addition, these were just unlikely cases but not impossible ones especially for those unlikely young age combinations such as type A, B, C, D, or E (Table 5).

Table 5. Data validation check by cancer site, histology and sex

Combination	Type*	Frequency	Province					Year					No. of cases by age groups	No. of cases by ICD-OC	No. of cases by ICD-OM
			Ardebil	Gilan	Mazandaran	Golestan	Kerman	1996	1997	1998	1999	2000			
Age/site	A	9	1	1	7	0	0	0	2	2	0	2	0–4=5, 5–9=2, 20–24=2	C61=1	8140=9
	B	6	0	0	6	0	0	0	0	0	2	3	0–4=6	C53=1, C61=5	8140=5, 8900=1
	C	44	4	9	20	6	5	2	4	5	7	11	0–4=11, 5–9=8, 10–14=7, 15–19=18	C15=16, C20=1, C21=1, C23=2, C24=1, C25=4, C38.4=1, C50=14, C53=1, C55=3	
	D	2	1	0	1	0	0	0	0	0	0	0	5–9=1, 10–14=1	C17=2	
	E	9	0	2	6	0	1	1	0	2	3	0	10–14=2, 15–19=7	C18=9	
	F	3	0	1	0	0	2	0	1	0	2	0	25–29=1, 40–44=1, 85+=1	C96=1	
	G	0	0	0	0	0	0	0	0	0	0	0			
Age/histology	H	6	0	0	2	0	4	0	4	2	0	0	5–9=1, 15–19=3, 20–24=2	C42=6	
	I	36	1	7	22	1	5	5	1	4	7	5	15–19=13, 20–24=6, 25–29=2, 30–74=15		8910=3, 8960=5, 8970=2, 8981=1, 9470=17, 9687=8
Sex/site	J	0	0	0	0	0	0	0	0	0	0	0			
	K	0	0	0	0	0	0	0	0	0	0	0			
Sex/histology	L	9	1	3	3	0	2	1	1	1	2	0	0–4=1, 20–24=1, 50–54=1, 55–59=3, 60–64=2, 70–74=1		8380=1, 8460=2, 8470=2, 8670=1, 9000=1, 9084=1, 9090=1
	M	1	0	0	1	0	0	0	0	0	0	0	15–19=1	C56=1	9061=1

*= The validity check type mentioned below (Parkin et al. 1994, 45):

Presence of unlikely age/site combinations:

A: If age is less than 40 and site is C61 (Prostate) and histology is 814_ (Adenocarcinoma)

B: If age is less than 5 and site is C53 (Cervix uteri) or C61 (Prostate):

C: If age is less than 20 and site is C15 (Esophagus), 19, 20 (Rectum), 21 (Anus), 23, 24 (Gallbladder), 25 (Pancreas), 38.4 (Pleura), 50 (Breast), 54, 55 (Uterus), or 53 (Cervix Uteri):

D: If age is less than 20 and site is C17 (small intestine) and histology is less than 9590 (i.e. not lymphoma)

*E: If age is less than 20 and site is C33, 34 (Lung, trachea & bronchus) or 18 (Colon) and histology is not equal to 824_*

F: If age is more than 5 and histology is 9510 (Retinoblastoma) or 9512 (Retinoblastoma undif.) and site is C69 (Eye)

G: If age is less than 15 or more than 45 and site is C58 (Placenta) and histology is 9100 (Choriocarcinoma)

Presence of Unlikely age/histology combinations:

H: If age is less than or equal to 25 and histology is 9730, 9823, 9863 or 9890

I: If age is greater than or equal to 15 and histology is 8910, 8960, 8961–2, 8970, 8981, 8991, 9072, 9470, 9687 or 9750

Presence of Impossible sex/site combinations:

J: If sex is male and site is C51–C58

K: If sex is female and C60–63

Wrong or unlikely sex/histology combinations:

L: If sex is male and histology is 8380–1, 8441, 8460–2, 8470–3, 8600–2, 8610, 8620–3, 8632, 8660, 8670, 8931, 9000, 9013–5, 9084 or 9090–1

M: If sex is female and histology is 9061–3 or 9102

For instance, type “A” in Table 5 denotes number of prostate cancer cases (C61) that their age was less than 40 years and their cancer morphology was adenocarcinoma (8140–49).

Half of Iran's population is under 25 years old and among 30,000,000 young people, some rare (unlikely) cases may appear as was seen for colorectal cancer in young age in Iran.

5.3 Cancer incidence

5.3.1 Age-specific rates and curves

Age-specific rates for 5 major cancers in men and women are shown Figure 7 to Figure 12. Details of age-specific rates for all cancer sites are tabulated in the appendix (Appendix Table 6 and Appendix Table 7). Occurrence of most of cancers increased by age (Figure 11 and Figure 12).

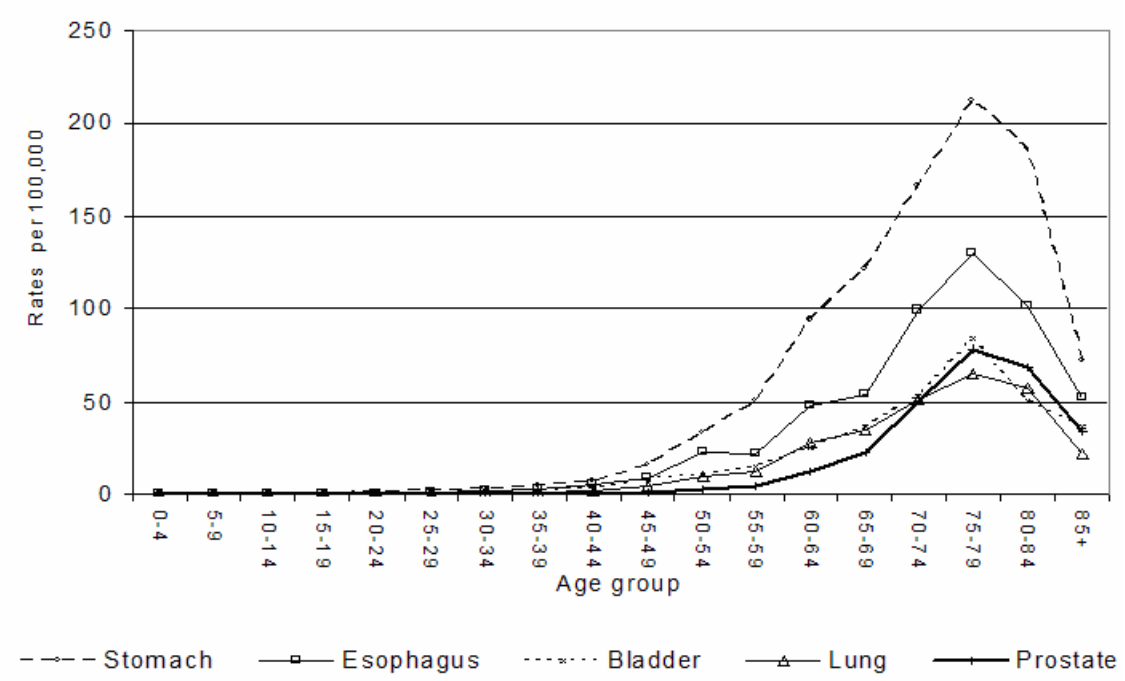

Figure 7. Age-specific incidence rate of five major cancers, male

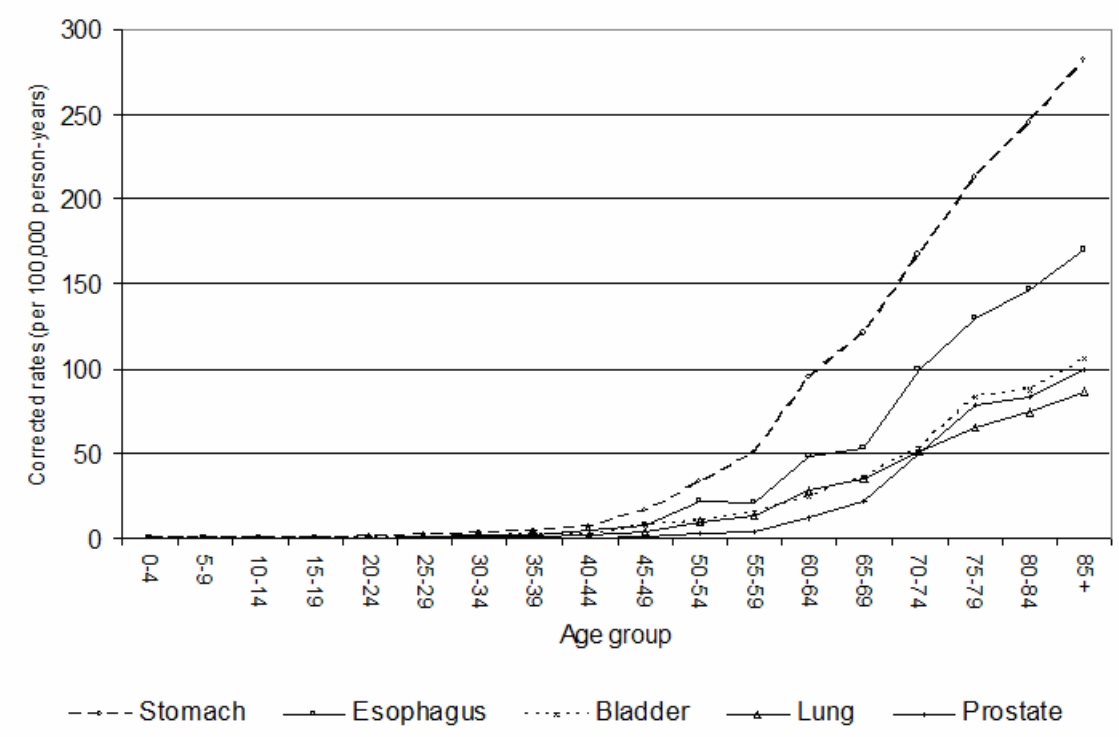

Figure 8. Corrected age-specific incidence rate, male

The decline at the older ages illustrated in the age-specific incidence curves in Figure 7 and Figure 10 for ages older than 79 could be due to under-registration. In this study, an attempt was made to correct this problem (Equation 1). Corrected curves are shown in Figure 8 and Figure 11.

Figure 8 shows that considering the age structure of men in these five provinces together, stomach cancer was the leading cancer in these areas after age 25. A logarithmic scale was used to show leading cancers before age 25 (Figure 9). Considering all cancers, the sixth leading cancer in men in terms of crude incidence rate, leukemia, was the leading cancer in childhood until age 25. Non-Hodgkin lymphoma was the second leading cancer for the age 0–25 followed by testis cancer as second leading cancer between age 25 to 40. However, esophageal cancer was the second leading cancer after age 40. Bladder cancer was relatively common with third rank in terms of incidence rate followed by lung and prostate cancer.

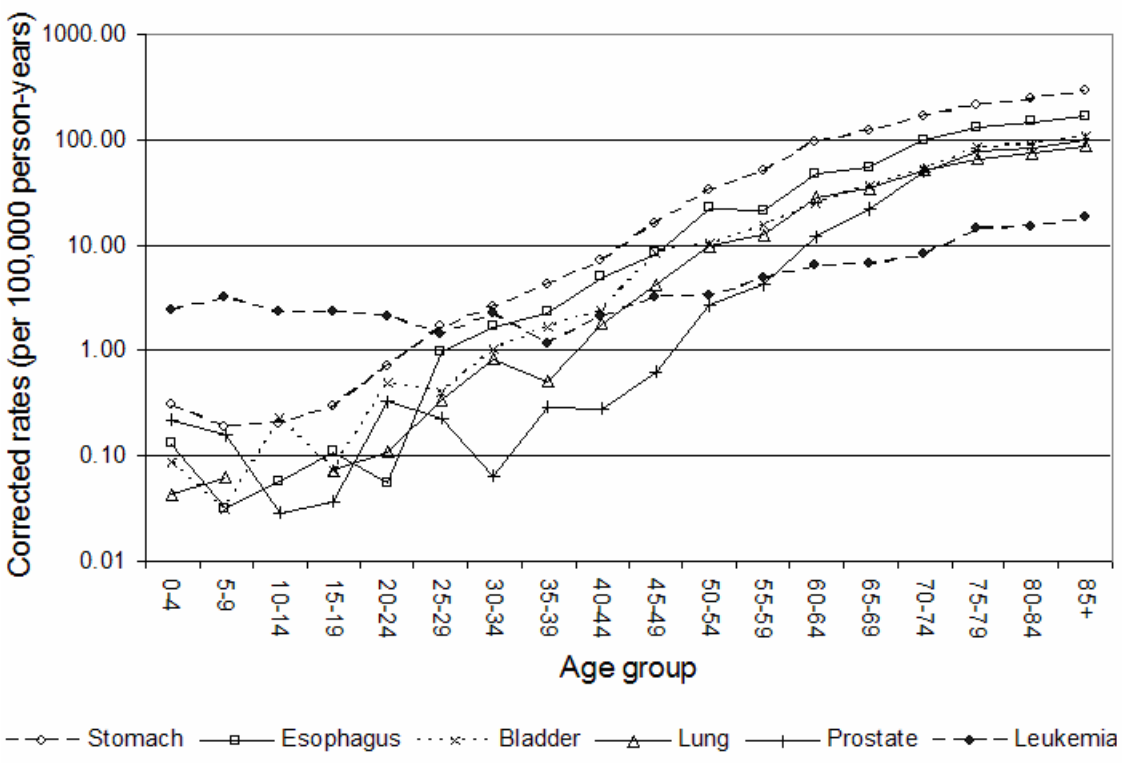

Figure 9. Corrected age-specific incidence rate in logarithmic scale, male

Among women, in four different periods of life, four different cancers were the leading cancer so that from birth to around the age 22, leukemia was the most common cancer (in terms of incidence). Thereafter, breast cancer had a remarkable increase until age 58 when esophageal cancer was the leading cancer for 5 years very close to stomach cancer, which was the most common cancer for elderly ages (Figure 10 and Figure 11). In terms of overall rank, breast was the first leading cancer in women while stomach and esophageal cancer were in second and third place. Colon cancer had the fourth rank followed by leukemia.

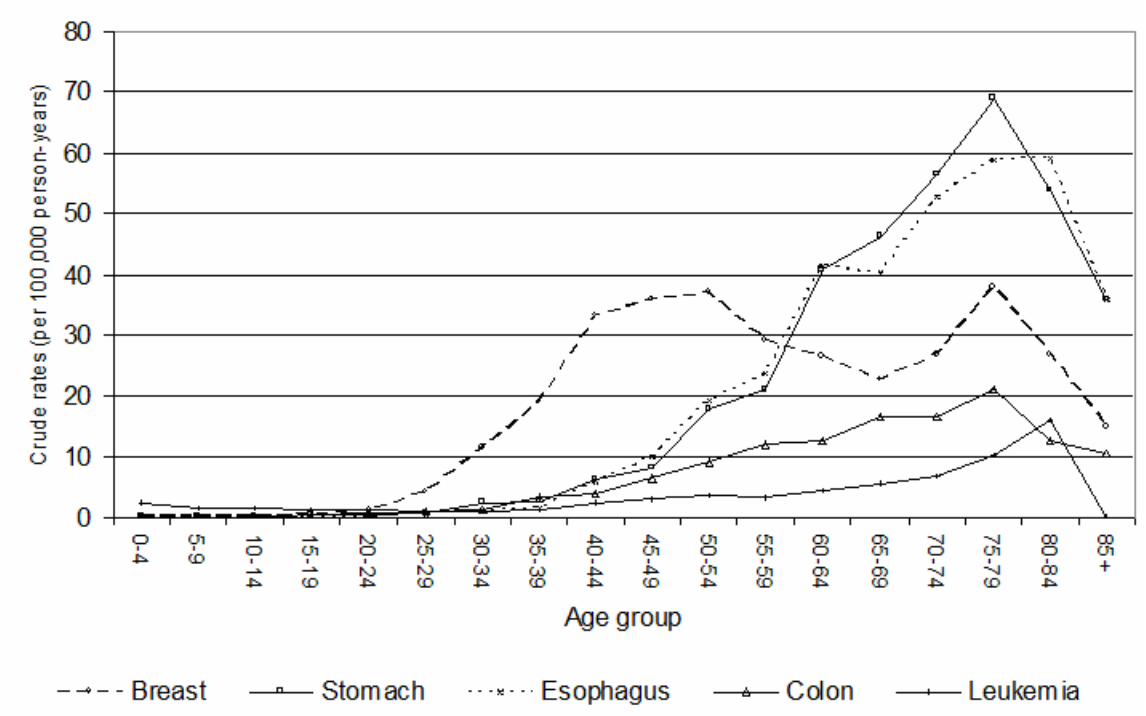

Figure 10. Age-specific incidence rate of five major cancers, female

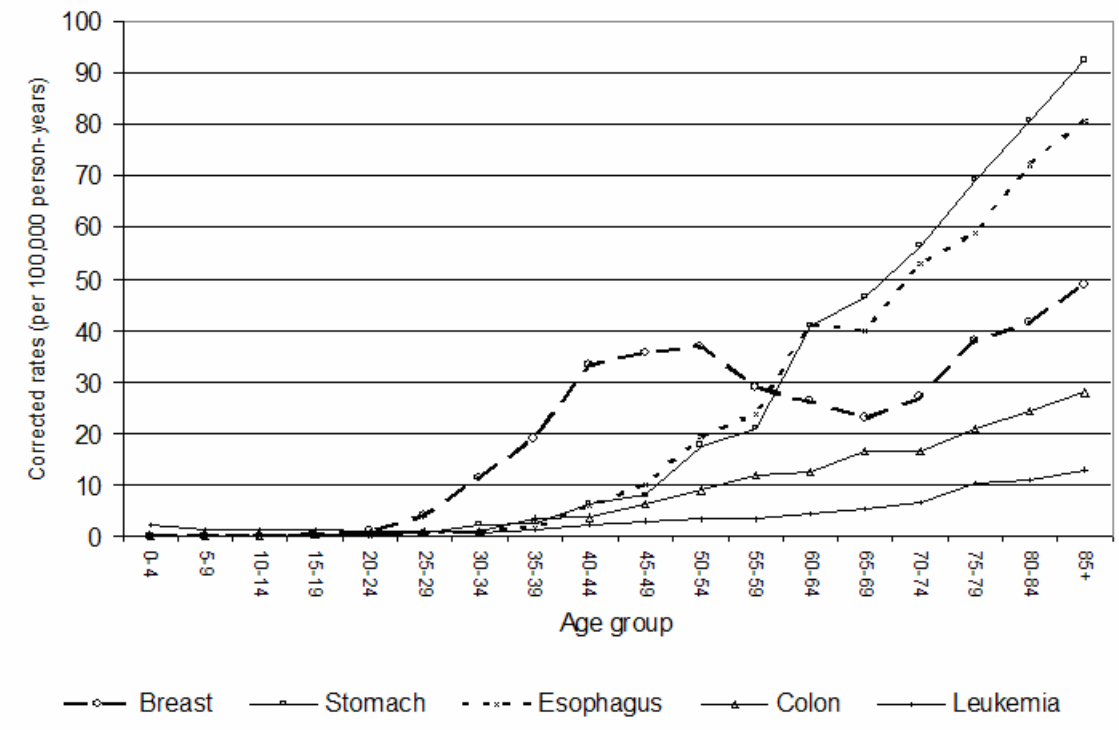

Figure 11. Corrected age-specific incidence rate, female

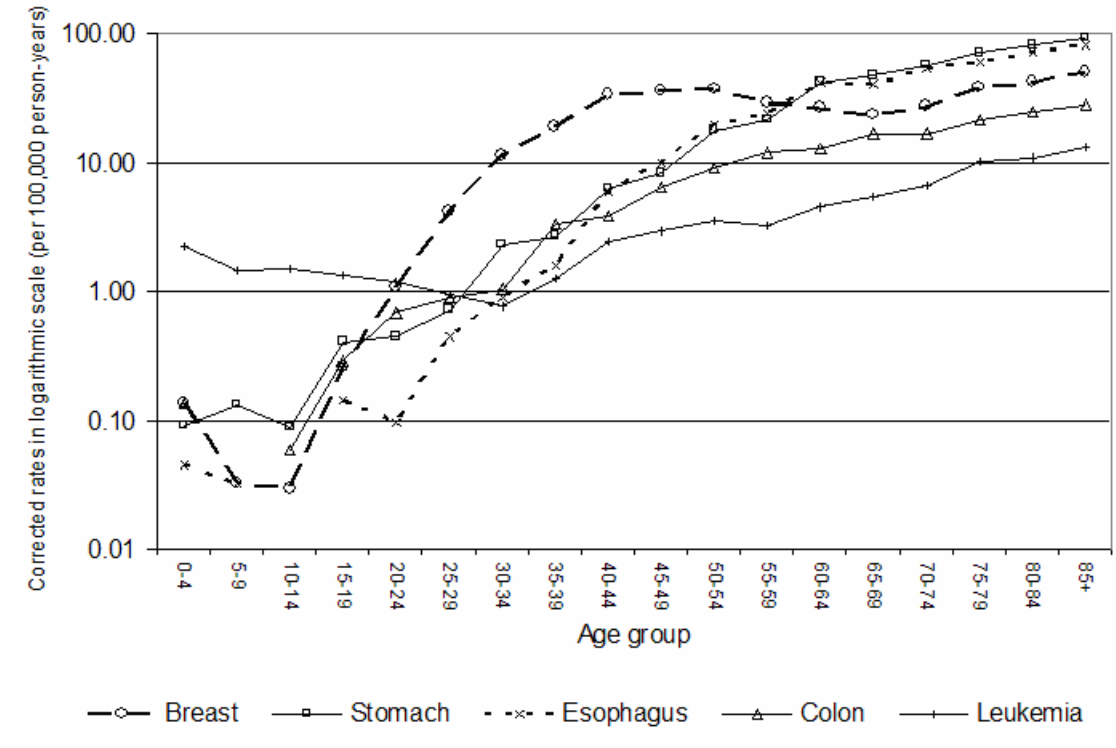

Figure 12. Corrected age-specific incidence rate in logarithmic scale, female

5.3.2 Relative frequencies and incidence rates

All the information and tables presented in the text of this dissertation are corrected for the cases of unknown age and also for under-registration of elderly ages explained in Section 4.4. The appendix of this dissertation gives original data without correction.

Altogether during 23,063,384 man-years follow-up, 14,883 men were recorded as new cancer cases (Table 6). Of these cancer cases, stomach (23.1%), esophagus (12.3%), bladder (7.6%), lung (6.6%), and prostate (5.7%) constituted the majority of cancer cases. In terms of crude incidence rate, stomach (15.8), esophagus (8.4), bladder (5.3), prostate (4.8) and lung (4.5) were the leading cancers in men. Age-standardized rates (ASR) with 95% confidence interval are presented in Table 6 and Table 7. These age-standardized rates can be used as ASR in the whole country. Crude incidence rates for whole country are presented in Table 23 and Table 24.

Adjusting for age did not change the rank of three major cancers - stomach 22.5, esophagus 12.1, bladder 7.5, lung 6.5 and prostate 5.6. Cumulative rates (as approximates to

cumulative risks) by sex and cancer site are presented in Table 6 and Table 7. For every man in these provinces, the risk of any kind of cancer during 0–64 and 0–69 years of their life was approximately 5.6 and 7.9% respectively. Of this risk around 45% was due to gastrointestinal tract (mostly stomach, esophagus and to some extent colon).

Altogether during 22,981,260 women-years of follow-up, 10,864 women were recorded as new cancer cases in this study excluding other skin cancer cases (Table 7). Of these cancer cases, breast (19.8%), stomach (12.5%), esophagus (11.7%), colon (5.6%), and leukemia (4.4%) constituted the majority of female cancer cases. In terms of incidence rate (per 100,000 person-years), breast (9.95), stomach (6.3), esophagus (5.9), colon (2.9), and thyroid (1.8) were the major cancers in women.

In terms of age-standardized rate (per 100,000 person-years), breast 13.3, stomach 9.3, esophagus 8.9, colon 4.0 and thyroid 1.9 were the major incident cancers in women.

Table 6. Relative frequency, crude incidence rate, age-standardized rate (ASR) and cumulative rate by cancer site, male

Site	ICD-O codes	No. of cases	Relative freq. % (excluding skin)	Crude rate (per 10^5)	ASR (per 10^5)	95% CI for ASR		Cumulative rate (percent)		95% CI for cumulative rate 0–69	
								0–64	0–69		
Stomach	C16	3432	23.1	15.8	22.54	22.29	22.79	1.12	1.76	1.64	1.88
Esophagus	C15	1835	12.3	8.36	12.13	11.94	12.31	0.58	0.86	0.77	0.95
Other skin	C44 excluding M8720–99	1593		7.44	10.46	10.28	10.63	0.56	0.79	0.71	0.87
Bladder	C67	1137	7.6	5.28	7.50	7.35	7.64	0.35	0.55	0.47	0.62
Prostate	C61	855	5.7	4.8	5.62	5.48	5.76	0.14	0.28	0.20	0.37
Lung, trachea & bronchus	C33–34	984	6.6	4.52	6.50	6.36	6.63	0.31	0.49	0.43	0.56
Colon	C18	622	4.2	2.90	3.87	3.77	3.97	0.24	0.31	0.27	0.35
Non-Hodgkin lymphoma	M9590–5, 9670–9729, 9740–9	605	4.1	2.76	3.44	3.35	3.54	0.22	0.28	0.24	0.31
Leukemia unspecified	M9800–9	509	3.4	2.36	2.24	2.17	2.31	0.13	0.15	0.12	0.17
Larynx	C32	435	2.9	2.06	2.90	2.81	2.99	0.16	0.23	0.19	0.28
Brain, nervous system	C70–71	399	2.7	1.82	2.18	2.11	2.26	0.15	0.18	0.16	0.20
Rectum	C19–20	359	2.4	1.71	2.33	2.25	2.41	0.13	0.18	0.14	0.21
Hodgkin disease	M9650–67	246	1.7	1.13	1.21	1.16	1.26	0.09	0.09	0.08	0.11
Pancreas	C25	203	1.4	1.02	1.32	1.26	1.39	0.06	0.11	0.08	0.14
Liver	C22	210	1.4	0.99	1.36	1.3	1.42	0.07	0.1	0.07	0.13
Kidney	C64	201	1.4	0.93	1.25	1.19	1.3	0.08	0.11	0.08	0.13
Bone	C40–41	197	1.3	0.9	0.98	0.93	1.02	0.06	0.08	0.06	0.09
Testis	C62	194	1.3	0.89	0.95	0.9	0.99	0.07	0.07	0.06	0.08
Multiple myeloma	M9730–4, M9830	176	1.2	0.81	1.16	1.1	1.21	0.07	0.1	0.08	0.12
Breast	C50	160	1.1	0.73	1.05	0.99	1.10	0.08	0.08	0.06	0.10
Thyroid	C73	116	0.8	0.58	0.69	0.64	0.73	0.05	0.06	0.04	0.07
Connective and soft tissue	C47+49	114	0.8	0.57	0.66	0.62	0.70	0.05	0.06	0.05	0.07
Lip	C00	121	0.8	0.55	0.8	0.75	0.84	0.04	0.06	0.04	0.08
Lymphoid leukemia	M9820–9, M9940-1	119	0.8	0.54	0.73	0.68	0.77	0.04	0.06	0.04	0.08
Nasopharynx	C11	104	0.7	0.48	0.64	0.6	0.68	0.04	0.05	0.04	0.07
Melanoma of skin	M8720–99	95	0.6	0.43	0.6	0.56	0.64	0.03	0.04	0.02	0.06
Gallbladder	C23–24	93	0.6	0.42	0.62	0.58	0.66	0.03	0.05	0.03	0.07
Small intestine	C17	74	0.5	0.35	0.48	0.45	0.52	0.03	0.04	0.02	0.05
Mouth	C03–06	66	0.4	0.31	0.43	0.4	0.47	0.03	0.03	0.02	0.05
Myeloid leukemia	M9860–99, 9840–50, 9900, 9910, 9930–2	61	0.4	0.29	0.33	0.3	0.35	0.02	0.03	0.02	0.04
Other thoracic organs	C37–38	56	0.4	0.25	0.34	0.31	0.37	0.02	0.03	0.02	0.04
Tongue	C01–02	50	0.3	0.23	0.33	0.3	0.35	0.02	0.03	0.02	0.04
Pharynx unspecified	C14	40	0.3	0.18	0.26	0.24	0.29	0.01	0.03	0.02	0.03
Salivary glands	C07–08	41	0.3	0.18	0.24	0.22	0.27	0.02	0.03	0.01	0.04
Anus	C21	38	0.3	0.17	0.24	0.21	0.26	0.02	0.02	0.01	0.03
Nose, sinuses	C30–31	37	0.2	0.16	0.22	0.19	0.24	0.01	0.02	0.01	0.03
Hypopharynx	C12–13	27	0.2	0.13	0.18	0.16	0.20	0.01	0.01	0.01	0.02
Kaposi sarcoma	M9140	24	0.2	0.11	0.15	0.13	0.17	0.01	0.01	0.01	0.02
Other endocrine	C75	18	0.1	0.09	0.09	0.08	0.11	0.01	0.01	0.01	0.01
Eye	C69	18	0.1	0.08	0.1	0.08	0.11	0.00	0.00	0.00	0.01
Tonsil	C09	14	0.1	0.06	0.09	0.07	0.10	0.00	0.01	0.00	0.01
Penis	C60	10	0.1	0.04	0.07	0.05	0.08	0.01	0.01	0.00	0.01
Mesothelioma	M9050–9 excluding C38.4	7	0.0	0.03	0.04	0.03	0.05	0.00	0.00	0.00	0.01
Renal pelvis	C65	2	0.0	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Other urinary organs	C68	3	0.0	0.01	0.02	0.01	0.03	0.00	0.00	0.00	0.00
Other oropharynx	C10	2	0.0	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Adrenal gland	C74	2	0.0	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Other male genitalia	C63	1	0.0	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Immunoproliferative	M9760–9	1	0.0	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Other and unspecified	O&U	769	5.2	3.58	4.54	4.43	4.65	0.25	0.35	0.30	0.40
All sites	All	16476		76.93	103.83	103.3	104.37	5.46	7.86	7.61	8.10
All sites excluding skin	All excluding C44	14883	100	69.49	93.38	92.87	93.89	4.90	7.07	6.84	7.30

Table 7. Relative frequency, crude incidence rate, age-standardized rate (ASR) and cumulative rate by cancer site, female

Site	ICD-O codes	No. of cases	Relative freq. % (excluding other skin)	Crude rate (per 10^5)	ASR (per 10^5)	95% CI for ASR		Cumulative rate (percent)		95% CI for cumulative rate 0–69	
								0–64	0–69		
Breast	C50	2151	19.8	9.95	13.3	13.11	13.49	1.05	1.17	9.95	1.12
Stomach	C16	1362	12.5	6.32	9.33	9.17	9.50	0.54	0.78	6.32	0.72
Esophagus	C15	1267	11.7	5.89	8.89	8.73	9.06	0.55	0.76	5.89	0.70
Other skin	C44 excluding M8720–99	1160		5.37	7.87	7.72	8.02	0.45	0.59	5.37	0.53
Colon	C18	612	5.6	2.86	4.03	3.93	4.14	0.27	0.36	2.86	0.32
Thyroid	C73	343	3.2	1.79	1.93	1.85	2	0.13	0.16	1.79	0.14
Leukemia unspecified	M9800–9	355	3.3	1.65	1.75	1.68	1.81	0.1	0.12	1.65	0.10
Ovary	C56	341	3.1	1.60	1.99	1.91	2.06	0.15	0.17	1.60	0.15
Cervix uteri	C53	341	3.1	1.54	2.25	2.17	2.33	0.18	0.21	1.54	0.19
Brain, nervous system	C70–71	319	2.9	1.43	1.73	1.66	1.79	0.13	0.15	1.43	0.13
Rectum	C19–20	295	2.7	1.39	1.98	1.90	2.05	0.15	0.17	1.39	0.15
Non-Hodgkin lymphoma	M9590–5, 9670–9729, 9740–9	293	2.7	1.37	1.65	1.58	1.71	0.11	0.13	1.37	0.11
Lung, trachea & bronchus	C33–34	241	2.2	1.12	1.63	1.56	1.70	0.08	0.12	1.12	0.09
Bladder	C67	226	2.1	1.10	1.55	1.48	1.62	0.09	0.13	1.10	0.10
Uterus unspecified	C55	164	1.5	0.79	1.05	0.99	1.10	0.08	0.10	0.79	0.09
Gallbladder	C23–24	168	1.5	0.78	1.15	1.10	1.21	0.06	0.08	0.78	0.06
Corpus uteri	C54	150	1.4	0.70	1.04	0.99	1.10	0.08	0.11	0.70	0.10
Hodgkin disease	M9650–67	148	1.4	0.66	0.65	0.62	0.69	0.05	0.05	0.66	0.05
Liver	C22	137	1.3	0.64	0.89	0.84	0.95	0.05	0.07	0.64	0.06
Pancreas	C25	129	1.2	0.64	0.88	0.83	0.93	0.04	0.06	0.64	0.04
Bone	C40–41	135	1.2	0.60	0.63	0.6	0.67	0.04	0.04	0.60	0.03
Kidney	C64	115	1.1	0.55	0.71	0.67	0.76	0.05	0.06	0.55	0.04
Connective and soft tissue	C47+49	95	0.9	0.49	0.54	0.5	0.58	0.04	0.05	0.49	0.04
Multiple myeloma	M9730–4, M9830	83	0.8	0.39	0.56	0.52	0.6	0.04	0.05	0.39	0.04
Tongue	C01–02	71	0.7	0.34	0.49	0.45	0.52	0.03	0.03	0.34	0.02
Melanoma of skin	M8720–99	71	0.7	0.34	0.46	0.42	0.49	0.03	0.03	0.34	0.02
Larynx	C32	69	0.6	0.31	0.46	0.42	0.49	0.03	0.04	0.31	0.03
Mouth	C03–06	68	0.6	0.30	0.46	0.43	0.5	0.02	0.04	0.30	0.02
Lymphoid leukemia	M9820–9, M9940–1	61	0.6	0.29	0.39	0.36	0.42	0.02	0.03	0.29	0.02
Lip	C00	54	0.5	0.25	0.37	0.33	0.4	0.02	0.03	0.25	0.02
Myeloid leukemia	M9860–99, 9840–50, 9900, 9910, 9930–2	53	0.5	0.24	0.29	0.26	0.31	0.02	0.02	0.24	0.01
Nasopharynx	C11	47	0.4	0.23	0.28	0.26	0.31	0.02	0.03	0.23	0.02
Vagina	C52	41	0.4	0.19	0.27	0.24	0.29	0.02	0.03	0.19	0.02
Small intestine	C17	40	0.4	0.18	0.27	0.24	0.29	0.02	0.03	0.18	0.02
Salivary glands	C07–08	34	0.3	0.18	0.2	0.18	0.23	0.02	0.02	0.18	0.01
Eye	C69	36	0.3	0.16	0.22	0.20	0.24	0.01	0.01	0.16	0.00
Hypopharynx	C12–13	31	0.3	0.14	0.22	0.19	0.24	0.01	0.02	0.14	0.01
Other thoracic organs	C37–38	30	0.3	0.14	0.19	0.17	0.21	0.02	0.02	0.14	0.01
Pharynx unspecified	C14	28	0.3	0.13	0.2	0.17	0.22	0.01	0.02	0.13	0.02
Other female genitalia	C57	21	0.2	0.10	0.13	0.11	0.15	0.01	0.01	0.10	0.01
Nose, sinuses	C30–31	18	0.2	0.09	0.12	0.10	0.14	0.01	0.01	0.09	0.00
Anus	C21	17	0.2	0.08	0.13	0.11	0.14	0.01	0.01	0.08	0.01
Vulva	C51	17	0.2	0.08	0.12	0.10	0.14	0.01	0.01	0.08	0.00
Other endocrine	C75	10	0.1	0.05	0.06	0.05	0.07	0.01	0.01	0.05	0.01
Tonsil	C09	9	0.1	0.04	0.07	0.05	0.08	0.00	0.01	0.04	0.00
Kaposi sarcoma	M9140	7	0.1	0.03	0.05	0.04	0.06	0.00	0.00	0.03	0.00
Mesothelioma	M9050–9 excluding C38.4	7	0.1	0.03	0.04	0.03	0.05	0.00	0.00	0.03	0.00
Adrenal gland	C74	4	0.0	0.02	0.02	0.01	0.03	0.00	0.00	0.02	0.00
Other urinary organs	C68	3	0.0	0.01	0.02	0.01	0.03	0.00	0.00	0.01	0.00
Placenta	C58	2	0.0	0.01	0.01	0.01	0.02	0.00	0.00	0.01	0.00
Ureter	C66	1	0.0	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Immunoproliferative	M9760–9	1	0.0	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Other and unspecified	O&U	540	5.0	2.67	3.24	3.14	3.33	0.20	0.26	2.67	0.23
All sites	All	12023		56.22	76.76	76.29	77.22	5.03	6.44	56.22	6.28
All sites excluding skin	All excluding C44	10864	100	50.85	68.88	68.45	69.32	4.58	5.85	50.85	5.70

For every woman, the risk of any kind of cancer during 0–64 and 0–69 years of their life was approximately 5.0 and 6.4% respectively. Of this risk, around 38% was from gastrointestinal tract (mostly stomach, esophagus and colon), and about 20% was due to breast cancer.

In all these five provinces and both sexes together, stomach was the most common cancer in terms of age-standardized incidence rate although it was higher in men. Esophageal cancer was in the second rank following by breast, bladder and lung cancers.

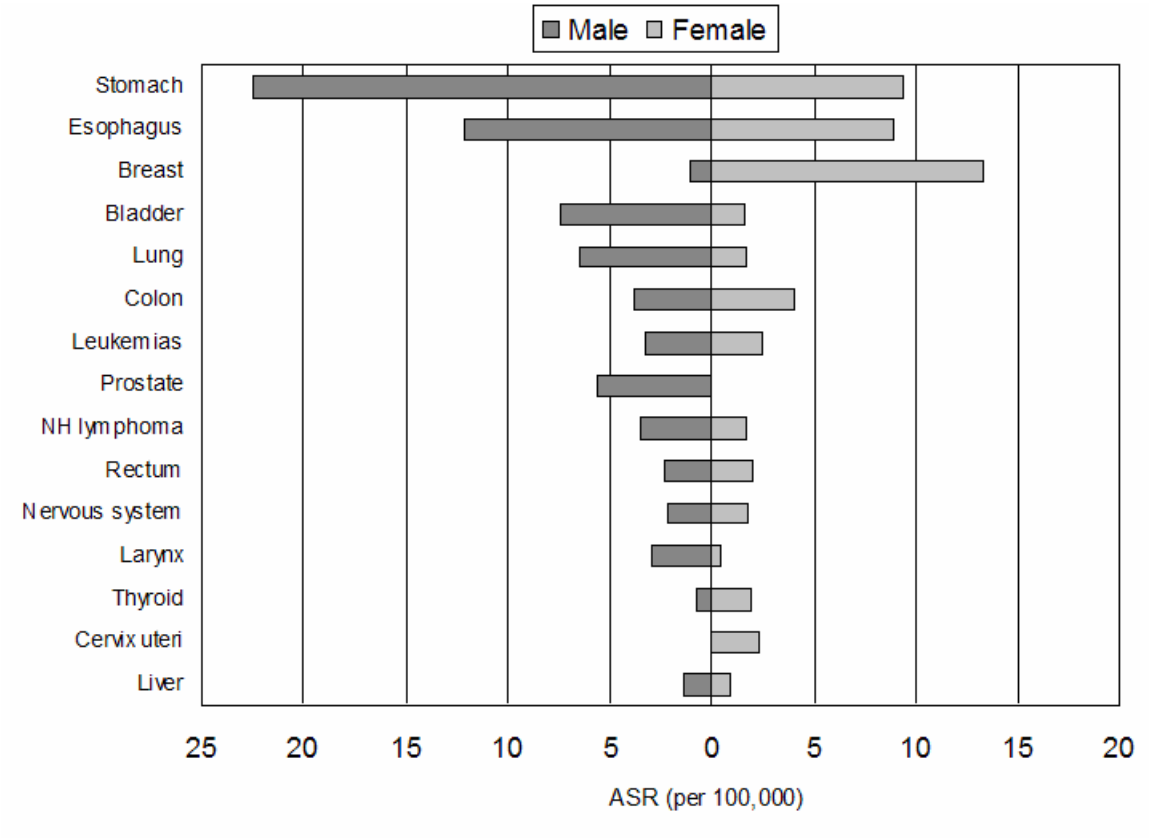

Figure 13. Age-standardized rate (ASR) in all five provinces by sex

5.3.3 Incidence rates by provinces

5.3.3.1 Ardebil

Stomach cancer was the leading cancer in Ardebil both in women and men with ASR 28 per 100,000 person-years for women and 55 for men (Figure 14). Esophageal cancer was the second most common cancer in this province with similar rank and rate in men and women (17–18 per 100,000 person-years). Third and fourth incident cancers in women were breast and uterus unspecified whereas in men lung and bladder came after stomach and esophageal cancers. Instead, there were very low ASRs for these two latter sites. Prostate cancer was in the 6th place after colon in men (Appendix Table 25).

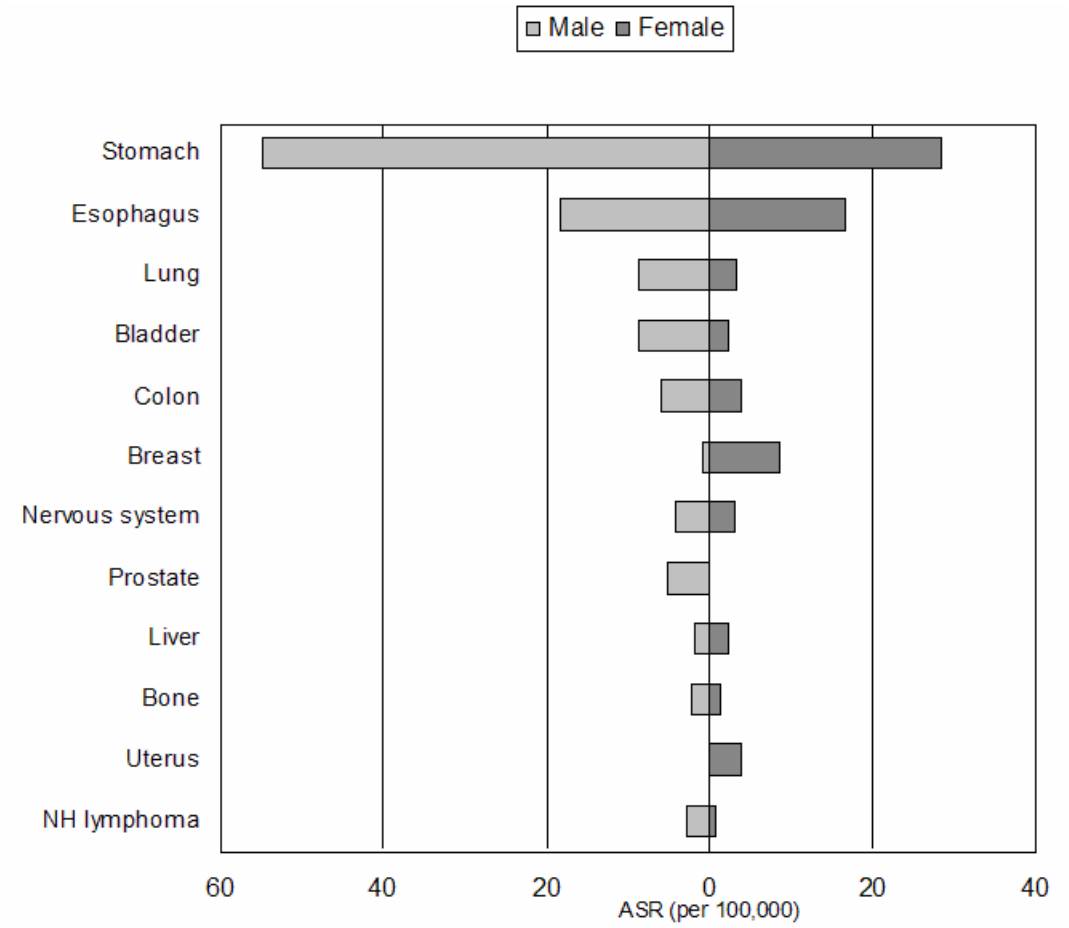

Figure 14. Age-standardized rate (ASR) in Ardebil province by sex, 1996–1999

The cumulative incidence of cancer (any kind) for men in Ardebil was 11.2% during 69 years of life (Table 8). The 69-year cumulative rate for stomach cancer was 4.1% followed by esophagus, 1.3%. Each man in Ardebil by age 69 had 5.4% probability of upper gastrointestinal malignancy.

Table 8. Cancer incidence rates in Ardebil province, male

Sites	Cases (N)	Relative freq. %	Crude rate (/100,000)	ASR* (/100,000)	95% CI for ASR		Cumulative rate (percent)		95% CI for cumulative rate 0–69	
							0–64	0–69		
Stomach	741	38.8	32.09	54.82	53.55	56.10	2.67	4.14	3.48	4.79
Esophagus	241	12.6	10.39	18.34	17.60	19.08	0.92	1.31	0.93	1.69
Other skin	195	0	9.00	14.23	13.56	14.91	0.80	1.02	0.70	1.35
Lung,	120	6.3	5.13	8.60	8.11	9.10	0.44	0.71	0.49	0.94
Bladder	117	6.1	5.04	8.58	8.07	9.08	0.44	0.61	0.35	0.87
Colon	83	4.3	3.52	5.96	5.54	6.37	0.29	0.40	0.19	0.60
Prostate	64	3.4	2.94	5.14	4.73	5.55	0.13	0.21	0.00	0.47
Brain, nervous system	67	3.5	2.84	4.17	3.83	4.50	0.28	0.34	0.21	0.47
Non-Hodgkin lymphoma	42	2.2	1.92	2.81	2.52	3.09	0.22	0.29	0.23	0.36
Bone	37	1.9	1.66	2.35	2.10	2.61	0.15	0.18	0.07	0.29
Kidney	37	1.9	1.61	2.41	2.15	2.67	0.19	0.22	0.13	0.31
Liver	27	1.4	1.24	1.85	1.62	2.09	0.07	0.12	0.01	0.23
Testis	17	0.9	0.72	0.72	0.61	0.84	0.05	0.05	0.04	0.06
Larynx	17	0.9	0.72	1.16	0.98	1.33	0.08	0.10	0.04	0.17
Rectum	16	0.8	0.68	0.99	0.84	1.15	0.09	0.09	0.06	0.12
Leukemia unspecified	14	0.7	0.59	0.79	0.65	0.93	0.07	0.07	0.04	0.10
Pancreas	12	0.6	0.51	0.87	0.72	1.03	0.04	0.07	0.00	0.15
Pharynx unspecified	12	0.6	0.51	0.91	0.75	1.08	0.04	0.08	0.00	0.17
Tongue	11	0.6	0.47	0.74	0.59	0.88	0.03	0.04	0.00	0.12
Connective & soft tissue	9	0.5	0.43	0.48	0.37	0.58	0.04	0.04	0.03	0.04
Gallbladder	10	0.5	0.42	0.63	0.50	0.75	0.03	0.04	0.00	0.09
Thyroid	10	0.5	0.42	0.65	0.51	0.78	0.05	0.06	0.03	0.09
Lymphoid leukemia	9	0.5	0.38	0.46	0.35	0.57	0.04	0.04	0.03	0.05
Hodgkin disease	9	0.5	0.38	0.47	0.37	0.57	0.03	0.03	0.01	0.06
Breast	9	0.5	0.38	0.75	0.59	0.90	0.05	0.06	0.00	0.12
Mouth	7	0.4	0.35	0.56	0.42	0.70	0.03	0.05	0.00	0.12
Hypopharynx	5	0.3	0.26	0.34	0.23	0.45	0.03	0.03	0.02	0.04
Myeloid leukemia	6	0.3	0.25	0.29	0.21	0.37	0.03	0.03	0.02	0.03
Nasopharynx	6	0.3	0.25	0.36	0.27	0.45	0.03	0.04	0.03	0.05
Anus	6	0.3	0.25	0.40	0.29	0.50	0.03	0.03	0.02	0.04
Multiple myeloma	4	0.2	0.23	0.25	0.16	0.34	0.02	0.03	0.02	0.05
Other endocrine	4	0.2	0.23	0.28	0.17	0.38	0.02	0.02	0.01	0.03
Melanoma of skin	5	0.3	0.21	0.30	0.22	0.39	0.02	0.04	0.03	0.05
Nose, sinuses	4	0.2	0.17	0.25	0.17	0.33	0.01	0.02	0.00	0.05
Small intestine	3	0.2	0.13	0.15	0.10	0.21	0.01	0.02	0.01	0.03
Kaposi sarcoma	3	0.2	0.13	0.18	0.11	0.24	0.01	0.01	0.01	0.02
Salivary glands	3	0.2	0.13	0.19	0.12	0.25	0.01	0.02	0.01	0.03
Tonsil	3	0.2	0.13	0.21	0.13	0.28	0.02	0.02	0.00	0.04
Eye	2	0.1	0.08	0.03	0.01	0.04	0.00	0.00	0.00	0.00
Other thoracic organs	2	0.1	0.08	0.14	0.08	0.20	0.01	0.01	0.01	0.02
Penis	2	0.1	0.08	0.15	0.09	0.22	0.01	0.01	0.00	0.04
Other and unspecified	113	5.9	4.96	6.80	6.37	7.23	0.36	0.53	0.33	0.72
All sites	2104	0	91.82	149.71	147.61	151.80	7.90	11.24	10.22	12.26
All sites excluding skin	1909	100	82.85	135.50	133.51	137.48	7.10	10.22	9.25	11.18

* ASR=Age-standardized rate

The cumulative rate for women in Ardebil was generally lower than men; they had 8.7% probability of any cancer (Table 9). Similar to men, most of this risk in women was due to

upper GI cancer (stomach 2.3%; esophagus 1.4%) followed by skin and breast cancer (0.7%).

Table 9. Cancer incidence rates in Ardebil province, female

Sites	Cases (N)	Relative freq. %	Crude rate (/100,000)	ASR* (/100,000)	95% CI for ASR		Cumulative rate (percent)		95% CI for cumulative rate 0–69	
							0–64	0–69		
Stomach	337	26.5	14.79	28.48	27.51	29.45	1.73	2.28	1.84	2.71
Esophagus	212	16.6	9.82	16.68	15.92	17.44	1.02	1.40	1.08	1.71
Other skin	131		5.94	9.46	8.92	10.01	0.56	0.70	0.47	0.92
Breast	108	8.5	4.80	8.43	7.92	8.95	0.52	0.62	0.39	0.85
Uterus unspecified	51	4	2.25	3.83	3.49	4.17	0.30	0.35	0.25	0.45
Colon	48	3.8	2.08	3.94	3.58	4.29	0.25	0.31	0.15	0.46
Brain, nervous system	47	3.7	2.03	3.09	2.79	3.38	0.23	0.28	0.18	0.37
Lung	42	3.3	1.86	3.27	2.95	3.59	0.17	0.24	0.11	0.38
Liver	31	2.4	1.39	2.34	2.08	2.61	0.14	0.23	0.15	0.31
Gallbladder	26	2.0	1.33	2.32	2.02	2.62	0.14	0.17	0.04	0.29
Bladder	29	2.3	1.30	2.46	2.18	2.74	0.15	0.18	0.06	0.31
Thyroid	22	1.7	1.23	1.27	1.07	1.47	0.10	0.13	0.11	0.15
Ovary	24	1.9	1.13	1.65	1.43	1.88	0.11	0.11	0.03	0.18
Bone	26	2.0	1.12	1.48	1.29	1.68	0.11	0.12	0.07	0.17
Rectum	20	1.6	0.96	1.47	1.25	1.68	0.10	0.15	0.10	0.20
Non-Hodgkin lymphoma	15	1.2	0.75	0.69	0.56	0.82	0.06	0.06	0.05	0.07
Leukemia unspecified	15	1.2	0.70	0.96	0.79	1.12	0.07	0.08	0.05	0.12
Tongue	9	0.7	0.58	1.21	0.95	1.48	0.02	0.02	0.00	0.20
Cervix uteri	11	0.9	0.52	0.93	0.75	1.11	0.06	0.07	0.00	0.15
Pancreas	12	0.9	0.52	0.93	0.76	1.10	0.08	0.10	0.06	0.14
Hodgkin disease	11	0.9	0.48	0.46	0.37	0.55	0.03	0.04	0.03	0.05
Anus	7	0.5	0.35	0.48	0.35	0.62	0.04	0.04	0.00	0.08
Connective & soft tissue	7	0.5	0.30	0.34	0.25	0.44	0.03	0.03	0.02	0.04
Pharynx unspecified	6	0.5	0.26	0.45	0.33	0.56	0.04	0.06	0.04	0.07
Eye	6	0.5	0.26	0.34	0.25	0.43	0.01	0.01	0.00	0.05
Lymphoid leukemia	6	0.5	0.26	0.37	0.27	0.46	0.02	0.04	0.02	0.05
Corpus uteri	5	0.4	0.22	0.40	0.29	0.51	0.03	0.05	0.03	0.06
Myeloid leukemia	5	0.4	0.22	0.24	0.17	0.31	0.02	0.02	0.01	0.02
Salivary glands	4	0.3	0.17	0.27	0.18	0.35	0.02	0.03	0.02	0.04
Larynx	4	0.3	0.17	0.24	0.17	0.32	0.02	0.02	0.01	0.03
Melanoma of skin	4	0.3	0.17	0.19	0.13	0.26	0.02	0.02	0.01	0.02
Tonsil	3	0.2	0.13	0.40	0.27	0.52	0.02	0.02	0.00	0.10
Vagina	3	0.2	0.13	0.25	0.16	0.34	0.03	0.03	0.02	0.04
Nasopharynx	2	0.2	0.09	0.13	0.07	0.19	0.01	0.01	0.01	0.01
Hypopharynx	2	0.2	0.09	0.17	0.10	0.24	0.02	0.02	0.01	0.02
Other thoracic organs	2	0.2	0.09	0.17	0.10	0.24	0.01	0.01	0.00	0.04
Vulva	2	0.2	0.09	0.14	0.08	0.20	0.00	0.02	0.01	0.03
Multiple myeloma	2	0.2	0.09	0.13	0.08	0.19	0.01	0.02	0.01	0.03
Small intestine	1	0.1	0.04	0.08	0.03	0.14	0.01	0.01	0.00	0.01
Nose, sinuses	1	0.1	0.04	0.24	0.13	0.34	0.00	0.00	0.00	0.08
Placenta	1	0.1	0.04	0.05	0.02	0.08	0.00	0.00	0.00	0.01
Other urinary organs	1	0.1	0.04	0.08	0.03	0.13	0.01	0.01	0.00	0.02
Other endocrine	1	0.1	0.04	0.08	0.03	0.13	0.01	0.01	0.00	0.02
Other and unspecified	102	8.0	6.25	6.86	6.33	7.38	0.42	0.52	0.31	0.73
All sites	1405		64.63	107.72	105.83	109.60	6.75	8.66	7.89	9.43
All sites excluding skin	1274	100	58.69	98.26	96.46	100.07	6.19	7.96	7.22	8.71

* ASR=Age-standardized rate

Figure 15 and Figure 16 show the rank and pattern of age-specific incidence rates and total crude incidence rate in Ardebil. Stomach cancer and esophageal cancers were the leading cancers in Ardebil in both sexes. Lung was the third common cancer among men. Breast was in the third rank in women. Brain, leukemia, and bone cancers were the most common cancers under age 20 in both sexes (Appendix Table 8 and Appendix Table 9).

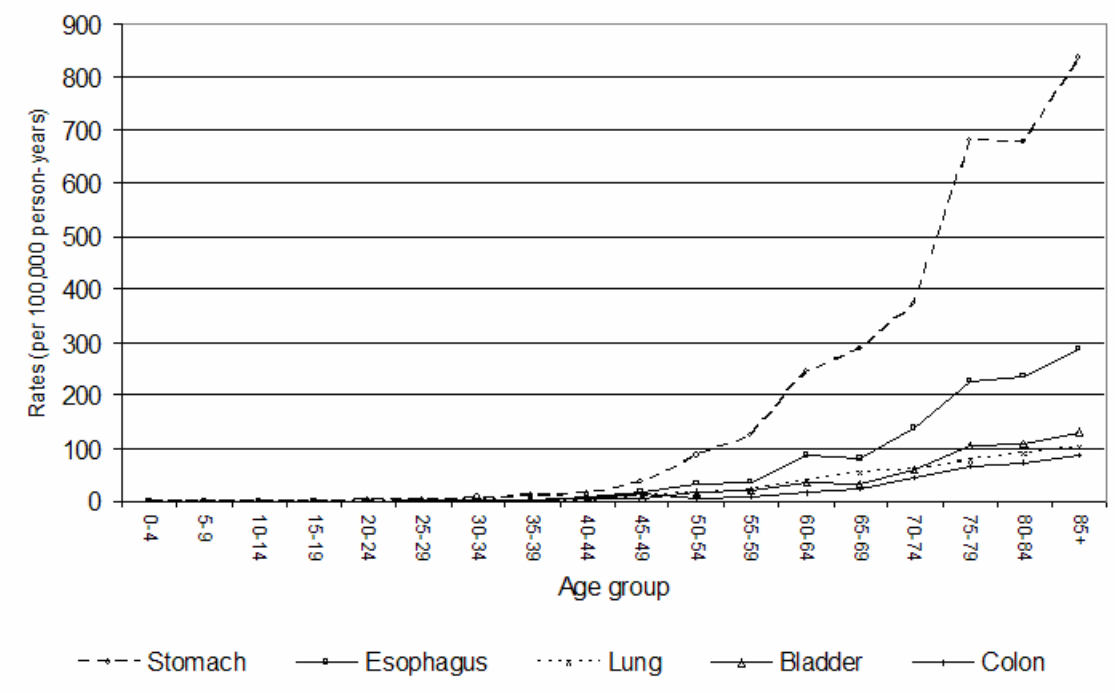

Figure 15. Age-specific incidence rate in Ardebil, male

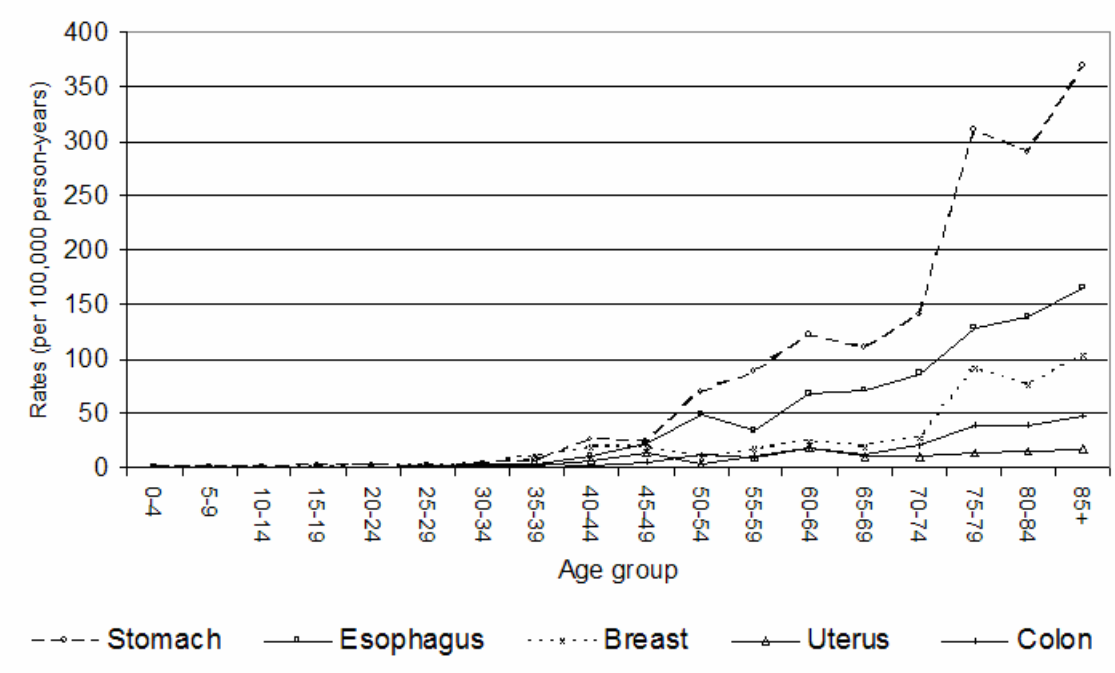

Figure 16. Age-specific incidence rate in Ardebil, female

5.3.3.2 Gilan

Considering ASR of both sexes together, stomach cancer was the leading cancer although breast cancer was the leading cancer in women (Figure 17). Esophageal cancer was the second most common cancer in men and third cancer in women after stomach. Bladder and prostate were the third and fourth common cancers in this northern province of Iran. Colon cancer had the fourth place in women and fifth place after lung in men.

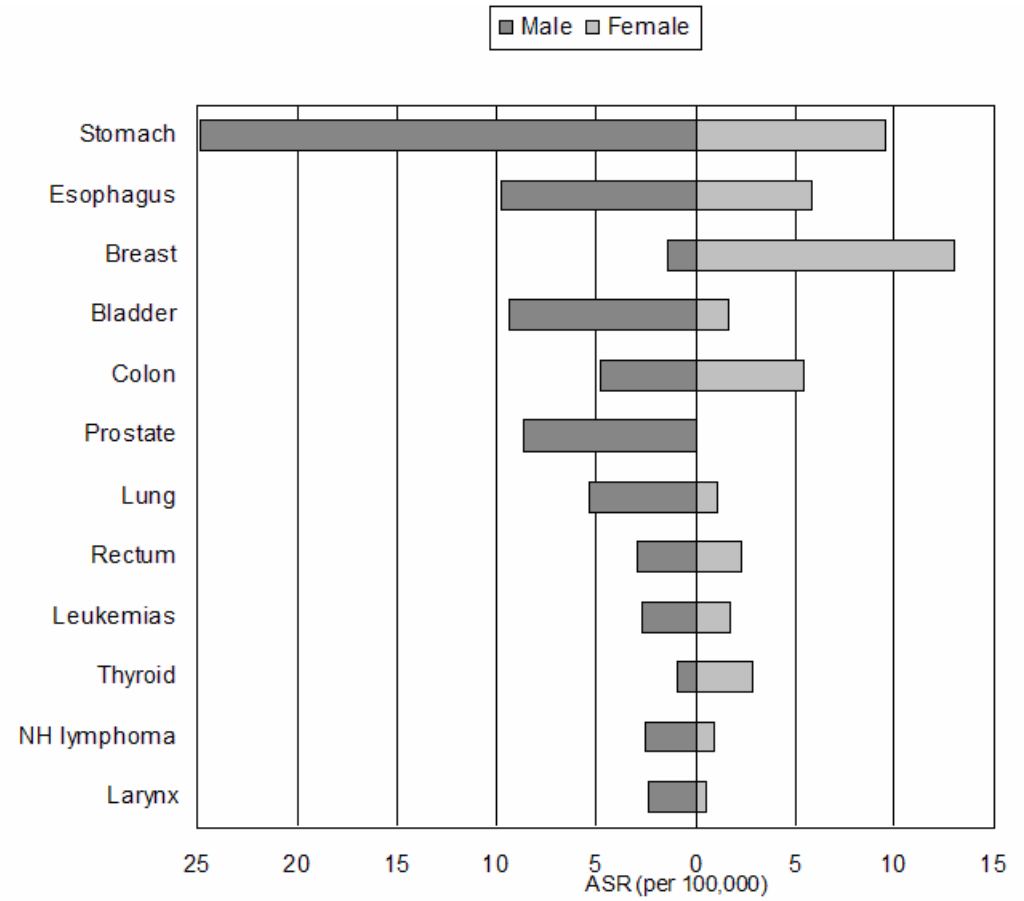

Figure 17. Age-standardized rate (ASR) in Gilan province by sex

Age-specific rates revealed that stomach cancer was the leading cancer in men at most ages (Figure 18). However, leukemia (age period 0–20) and testis cancer (age 20 to 30) were the most common cancers among boys. The age distribution among women was different so that after leukemia (0–15 years), Hodgkin disease and ovary were the leading cancers each for 5 years. Breast cancer was the leading cancer in the reproductive ages until stomach took first place after age 60 (Figure 19). Detailed age-specific rates can be found in Appendix Table 11 and Appendix Table 12.

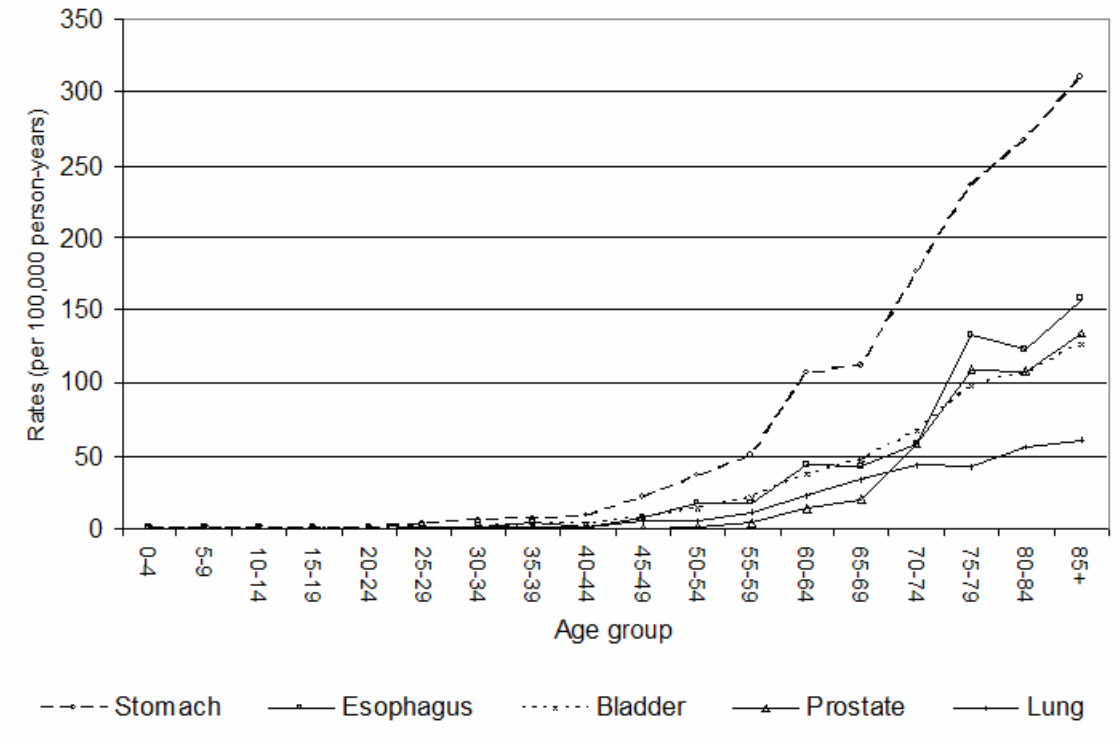

Figure 18. Age-specific incidence rate in Gilan, male

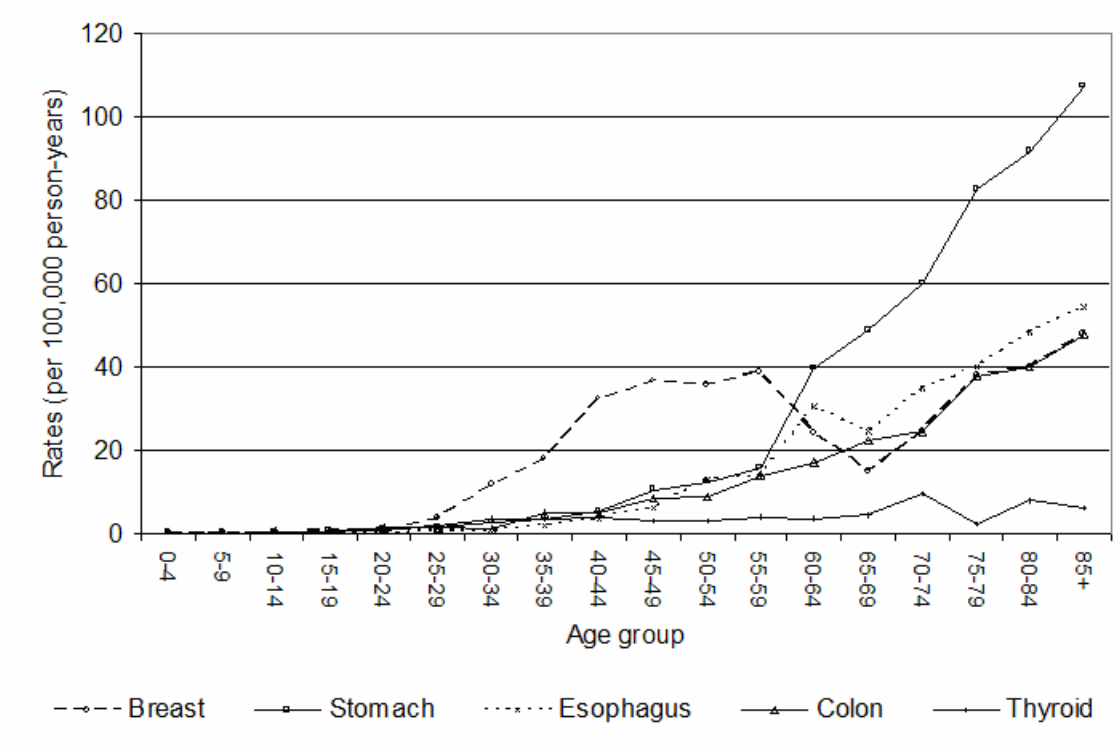

Figure 19. Age-specific incidence rate in Gilan, female

In terms of cumulative rate, in Gilanian men, stomach was in the highest risk by age 69 years with a probability of about 2% (Table 10). Bladder and esophagus had similar cumulative rate (0.7%); likewise lung and colon (0.4%). Risk of any kind of cancer for Gilanian men was 8% by age 69 years, of which the majority was due to gastrointestinal cancers.

Table 10. Cancer incidence rates in Gilan province, male

Sites	Cases (N)	Relative freq. (%)	Crude rate (/10^5)	ASR* (/10^5)	95% CI for ASR		Cumulative rate (%)		95% CI for cumulative rate 0–69 (%)	
							0–64	0–69		
Stomach	1019	25.2	19.91	24.93	24.42	25.44	1.29	1.90	1.64	2.15
Prostate	328	8.1	10.26	8.65	8.26	9.04	0.19	0.36	0.10	0.62
Other skin	419	0.0	7.77	10.01	9.69	10.33	0.55	0.77	0.62	0.92
Bladder	379	9.4	7.19	9.33	9.02	9.64	0.45	0.71	0.55	0.86
Esophagus	381	9.4	7.11	9.76	9.45	10.08	0.48	0.70	0.53	0.87
Lung	223	5.5	4.25	5.26	5.03	5.49	0.25	0.42	0.31	0.53
Colon	216	5.3	4.16	4.83	4.62	5.05	0.30	0.42	0.34	0.51
Leukemia unspecified	121	3.0	2.26	2.17	2.04	2.30	0.12	0.13	0.09	0.16
Rectum	113	2.8	2.18	2.85	2.68	3.02	0.15	0.20	0.11	0.28
Non-Hodgkin lymphoma	116	2.9	2.15	2.52	2.37	2.67	0.16	0.17	0.11	0.24
Larynx	100	2.5	1.83	2.41	2.26	2.56	0.15	0.23	0.17	0.29
Pancreas	68	1.7	1.48	1.73	1.59	1.87	0.09	0.15	0.09	0.22
Testis	72	1.8	1.35	1.41	1.30	1.52	0.10	0.11	0.08	0.14
Kidney	63	1.6	1.21	1.64	1.50	1.77	0.09	0.12	0.05	0.19
Liver	60	1.5	1.15	1.49	1.36	1.61	0.08	0.12	0.05	0.18
Breast	56	1.4	1.04	1.36	1.24	1.48	0.10	0.11	0.07	0.15
Multiple myeloma	51	1.3	0.99	1.26	1.14	1.37	0.06	0.10	0.05	0.15
Brain, nervous system	52	1.3	0.97	1.08	0.99	1.18	0.08	0.09	0.06	0.12
Thyroid	39	1.0	0.91	0.83	0.73	0.92	0.07	0.08	0.06	0.10
Hodgkin disease	46	1.1	0.88	0.88	0.79	0.96	0.07	0.08	0.07	0.09
Bone	43	1.1	0.77	0.91	0.82	1.00	0.05	0.06	0.03	0.10
Lip	37	0.9	0.66	0.87	0.78	0.95	0.06	0.08	0.06	0.11
Small intestine	31	0.8	0.62	0.77	0.68	0.86	0.03	0.05	0.00	0.10
Connective & soft tissue	23	0.6	0.43	0.54	0.47	0.61	0.04	0.05	0.03	0.07
Mouth	21	0.5	0.40	0.50	0.43	0.57	0.03	0.03	0.00	0.07
Nasopharynx	22	0.5	0.39	0.53	0.46	0.60	0.03	0.05	0.02	0.07
Lymphoid leukemia	18	0.4	0.34	0.41	0.34	0.47	0.01	0.03	0.00	0.06
Other thoracic organs	17	0.4	0.32	0.40	0.34	0.46	0.02	0.03	0.00	0.06
Gallbladder	17	0.4	0.30	0.32	0.27	0.38	0.03	0.03	0.01	0.05
Nose, sinuses	14	0.3	0.27	0.32	0.26	0.38	0.02	0.02	0.00	0.05
Melanoma of skin	13	0.3	0.23	0.29	0.24	0.33	0.02	0.02	0.01	0.04
Pharynx unspecified	11	0.3	0.20	0.25	0.21	0.30	0.02	0.02	0.01	0.04
Kaposi sarcoma	10	0.2	0.20	0.25	0.19	0.30	0.00	0.02	0.00	0.05
Salivary glands	10	0.2	0.18	0.19	0.15	0.23	0.02	0.02	0.01	0.03
Other endocrine	3	0.1	0.16	0.06	0.02	0.10	0.00	0.00	0.00	0.01
Anus	7	0.2	0.13	0.14	0.10	0.17	0.01	0.02	0.01	0.02
Myeloid leukemia	6	0.1	0.11	0.14	0.10	0.17	0.01	0.01	0.01	0.01
Hypopharynx	5	0.1	0.09	0.10	0.07	0.12	0.01	0.01	0.01	0.01
Mesothelioma	3	0.1	0.05	0.09	0.06	0.12	0.00	0.00	0.00	0.02
Tonsil	3	0.1	0.05	0.07	0.04	0.09	0.00	0.01	0.00	0.02
Tongue	3	0.1	0.05	0.06	0.04	0.08	0.00	0.01	0.00	0.01
Eye	3	0.1	0.05	0.04	0.02	0.05	0.00	0.00	0.00	0.01
Penis	3	0.1	0.05	0.02	0.01	0.03	0.00	0.00	0.00	0.01
Other oropharynx	1	0.0	0.02	0.02	0.01	0.04	0.00	0.00	0.00	0.01
Immunoproliferative	1	0.0	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ureter	1	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other and unspecified	218	5.4	4.08	5.05	4.82	5.27	0.28	0.38	0.28	0.49
All sites	4466		87.61	106.32	105.27	107.37	5.63	8.02	7.51	8.52
All sites excluding skin	4047	100	79.87	96.31	95.31	97.31	5.08	7.25	6.76	7.73

* ASR=Age-standardized rate

Overall risk of cancer among Gilanian women was lower than men with 6% risk of cancer by age 69 years (Table 11). Most of this cancer risk was firstly due to breast cancer (1.1%) followed by stomach (0.8%), esophagus, colon and other skin (approximately 0.5% each).

Table 11. Cancer incidence rates in Gilan province, female

Sites	Cases (N)	Relative freq. (%)	Crude rate (/10^5)	ASR* (/10^5)	95% CI for ASR		Cumulative rate (%)		95% CI for cumulative rate 0–69 (%)	
							0–64	0–69		
Breast	572	20.1	10.78	13.02	12.67	13.37	1.06	1.14	1.06	1.23
Stomach	387	13.6	7.45	9.58	9.28	9.89	0.50	0.76	0.63	0.89
Other skin	274	0.0	5.05	6.55	6.30	6.80	0.36	0.46	0.36	0.57
Colon	233	8.2	4.48	5.50	5.27	5.73	0.34	0.46	0.37	0.54
Esophagus	233	8.2	4.42	5.85	5.61	6.09	0.37	0.50	0.41	0.59
Thyroid	137	4.8	3.47	2.82	2.64	3.00	0.20	0.23	0.18	0.28
Rectum	100	3.5	1.97	2.37	2.21	2.52	0.16	0.18	0.13	0.24
Ovary	105	3.7	1.94	2.28	2.14	2.42	0.18	0.21	0.17	0.25
Leukemia unspecified	75	2.6	1.47	1.49	1.38	1.61	0.08	0.09	0.05	0.12
Cervix uteri	80	2.8	1.46	1.84	1.70	1.97	0.16	0.18	0.15	0.21
Brain, nervous system	73	2.6	1.31	1.47	1.36	1.58	0.11	0.13	0.11	0.15
Corpus uteri	69	2.4	1.28	1.68	1.55	1.81	0.15	0.17	0.14	0.20
Bladder	68	2.4	1.28	1.59	1.47	1.71	0.08	0.13	0.08	0.18
Non-Hodgkin lymphoma	46	1.6	0.99	0.92	0.83	1.02	0.07	0.08	0.05	0.10
Kidney	45	1.6	0.92	1.07	0.96	1.17	0.07	0.09	0.06	0.13
Lung	46	1.6	0.89	1.12	1.02	1.23	0.06	0.10	0.06	0.14
Pancreas	40	1.4	0.86	1.03	0.93	1.14	0.04	0.06	0.01	0.11
Liver	44	1.5	0.84	1.04	0.94	1.14	0.06	0.09	0.06	0.12
Connective & soft tissue	30	1.1	0.80	0.64	0.55	0.73	0.04	0.06	0.04	0.08
Uterus unspecified	36	1.3	0.68	0.76	0.68	0.85	0.06	0.07	0.05	0.08
Gallbladder	32	1.1	0.59	0.90	0.81	0.99	0.04	0.05	0.00	0.10
Hodgkin disease	31	1.1	0.55	0.53	0.47	0.59	0.04	0.04	0.04	0.05
Bone	25	0.9	0.44	0.48	0.42	0.54	0.03	0.03	0.01	0.06
Larynx	21	0.7	0.39	0.50	0.43	0.56	0.03	0.04	0.02	0.07
Multiple myeloma	19	0.7	0.36	0.43	0.37	0.49	0.02	0.04	0.02	0.06
Tongue	19	0.7	0.34	0.42	0.36	0.48	0.04	0.04	0.03	0.05
Small intestine	13	0.5	0.25	0.29	0.24	0.34	0.03	0.03	0.03	0.04
Mouth	13	0.5	0.23	0.37	0.31	0.43	0.02	0.02	0.00	0.05
Melanoma of skin	13	0.5	0.23	0.26	0.21	0.30	0.01	0.02	0.01	0.04
Vagina	12	0.4	0.21	0.29	0.24	0.35	0.02	0.03	0.01	0.04
Lymphoid leukemia	9	0.3	0.21	0.20	0.15	0.25	0.01	0.02	0.02	0.03
Nasopharynx	11	0.4	0.20	0.25	0.20	0.30	0.02	0.03	0.02	0.03
Hypopharynx	8	0.3	0.14	0.17	0.14	0.21	0.00	0.01	0.00	0.02
Salivary glands	7	0.2	0.14	0.15	0.11	0.19	0.01	0.01	0.01	0.02
Nose, sinuses	6	0.2	0.13	0.16	0.11	0.20	0.01	0.01	0.00	0.02
Other thoracic organs	6	0.2	0.13	0.12	0.08	0.15	0.01	0.01	0.01	0.01
Other female genitalia	6	0.2	0.13	0.12	0.09	0.16	0.01	0.01	0.00	0.02
Pharynx unspecified	7	0.2	0.12	0.18	0.14	0.22	0.02	0.02	0.02	0.03
Kaposi sarcoma	6	0.2	0.11	0.14	0.10	0.18	0.00	0.00	0.00	0.03
Eye	5	0.2	0.11	0.12	0.08	0.16	0.01	0.01	0.01	0.02
Myeloid leukemia	5	0.2	0.09	0.09	0.06	0.11	0.00	0.00	0.00	0.01
Lip	4	0.1	0.07	0.11	0.08	0.15	0.00	0.01	0.00	0.03
Tonsil	3	0.1	0.05	0.07	0.04	0.09	0.00	0.01	0.01	0.01
Anus	2	0.1	0.04	0.05	0.03	0.07	0.01	0.01	0.00	0.01
Mesothelioma	2	0.1	0.04	0.05	0.03	0.08	0.01	0.01	0.00	0.01
Other urinary organs	2	0.1	0.04	0.05	0.03	0.08	0.01	0.01	0.00	0.01
Other endocrine	2	0.1	0.04	0.03	0.02	0.05	0.00	0.00	0.00	0.00
Vulva	1	0.0	0.02	0.03	0.01	0.05	0.00	0.00	0.00	0.00
Adrenal gland	1	0.0	0.02	0.02	0.01	0.04	0.00	0.00	0.00	0.00
Other and unspecified	132	4.6	2.46	2.85	2.69	3.01	0.17	0.25	0.19	0.30
All sites	3116	0.0	59.83	72.13	71.30	72.97	4.75	6.00	5.71	6.28
All sites excluding skin	2842	100.0	54.80	65.57	64.77	66.37	4.39	5.54	5.27	5.80

* ASR=Age-standardized rate

5.3.3.3 Mazandaran

In terms of ASR in both sexes together, stomach, esophagus, breast, lung and colon were the five leading cancers of this province (Figure 20). However the distribution of cancer was totally different between sexes. In women, breast cancer was the most common cancer followed by esophageal and gastric cancer, while in men the order was stomach, esophagus, lung, bladder and prostate. Some cancers such as esophagus, colorectal, leukemia, non-Hodgkin lymphoma and brain appeared roughly similar ASR among Mazandaranian men and women.

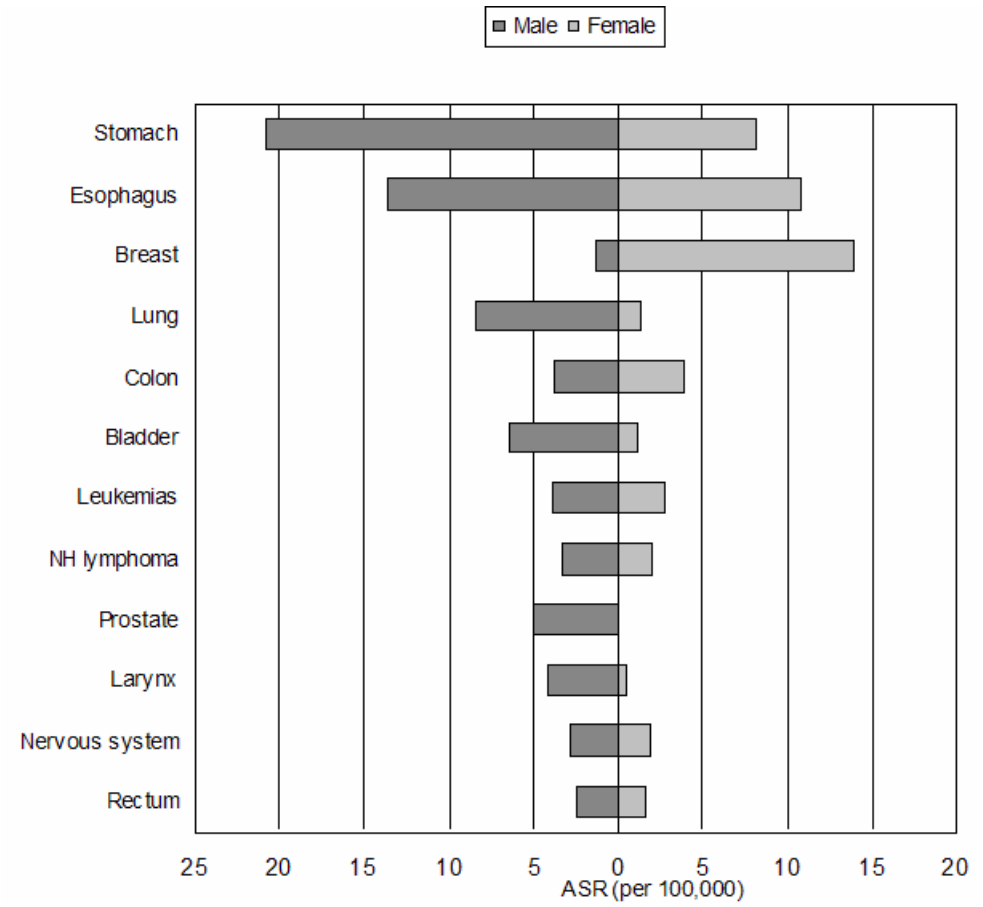

Figure 20. Age-standardized rate (ASR) in Mazandaran province by sex

The leading cancer until age 25 was leukemia in both girls and boys, but thereafter, in women breast was the most common cancer until age 60, while in men after leukemia, non-Hodgkin lymphoma and colon were the leading cancers each for 5 years and then esophagus was the common cancer in women and stomach cancer in men (Appendix Table 12 and Appendix Table 13).

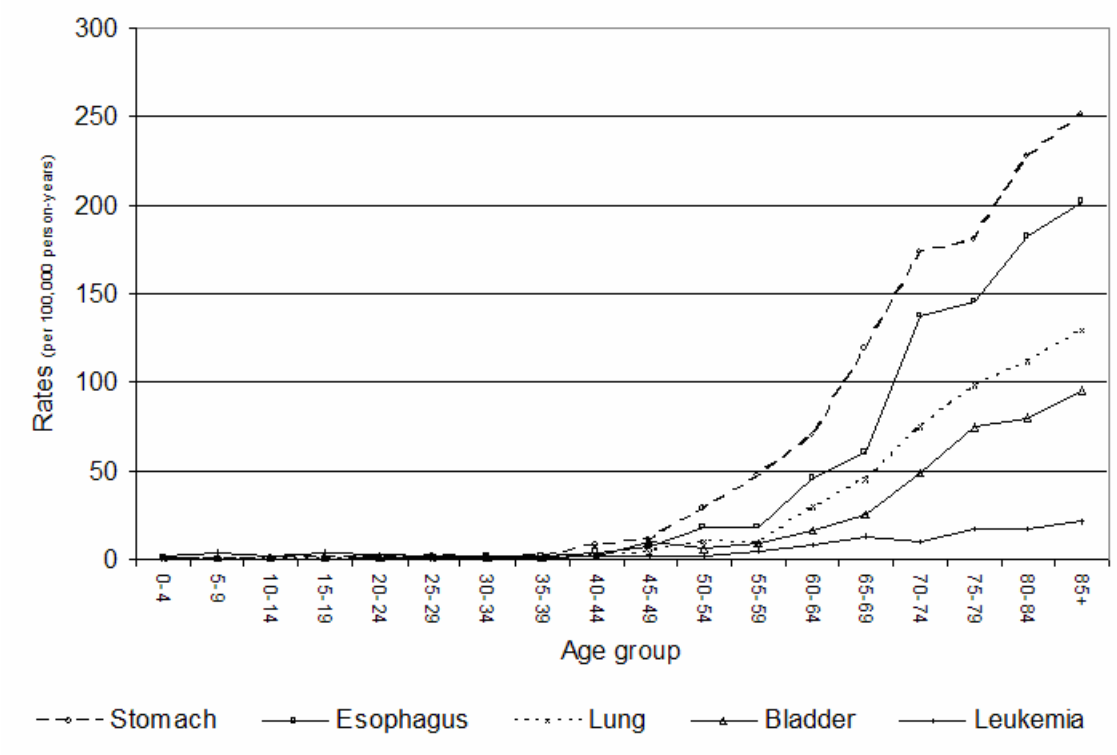

Figure 21. Age-specific incidence rate in Mazandaran, male

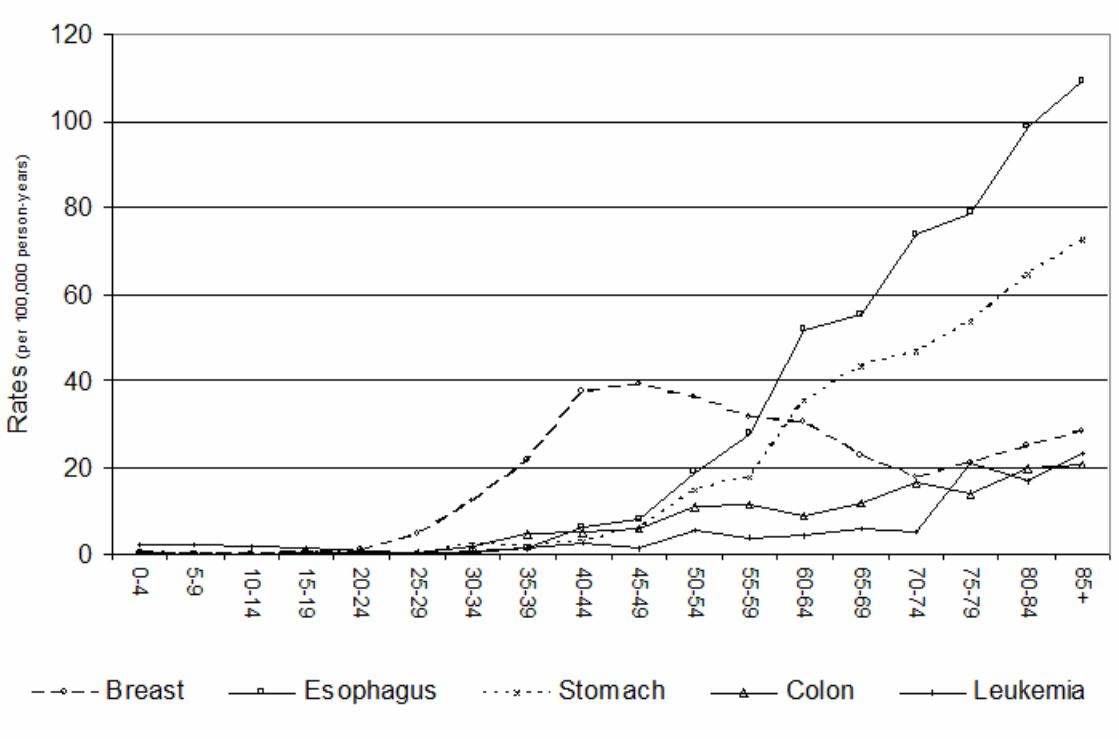

Figure 22. Age-specific incidence rate in Mazandaran, female

In terms of cumulative rate up to 69 years, each man in Mazandaran had approximately 7.75% risk of cancer of any kind (Table 12). Of this risk, the majority was due to stomach cancer (1.6% risk until age 69) followed by esophagus (0.9%), skin (0.75%), lung (0.6%) and bladder (0.4%).

Table 12. Cancer incidence rates in Mazandaran, male

Sites	Cases (N)	Relative freq. (%)	Crude rate ($/10^5$)	ASR* ($/10^5$)	95% CI for ASR		Cumulative rate (%)		95% CI for cumulative rate 0–69 (%)	
							0–64	0–69		
Stomach	894	20.6	15.01	20.81	20.36	21.26	0.94	1.59	1.38	1.80
Esophagus	578	13.3	9.76	13.69	13.32	14.05	0.54	0.88	0.69	1.06
Other skin	407	0.0	6.98	9.05	8.75	9.36	0.46	0.71	0.57	0.84
Lung	354	8.1	5.98	8.39	8.10	8.68	0.32	0.56	0.41	0.71
Bladder	273	6.3	4.71	6.39	6.13	6.64	0.27	0.41	0.28	0.54
Prostate	213	4.9	3.84	5.00	4.77	5.23	0.13	0.32	0.19	0.44
Larynx	172	4.0	3.17	4.20	3.99	4.41	0.21	0.32	0.22	0.43
Colon	181	4.2	3.14	3.82	3.63	4.01	0.26	0.30	0.23	0.37
Leukemia unspecified	182	4.2	2.99	2.87	2.73	3.01	0.16	0.20	0.15	0.24
Non-Hodgkin lymphoma	180	4.1	2.94	3.32	3.15	3.48	0.21	0.27	0.22	0.33
Brain, nervous system	151	3.5	2.51	2.88	2.72	3.04	0.18	0.23	0.17	0.28
Rectum	112	2.6	2.02	2.55	2.39	2.71	0.12	0.17	0.09	0.25
Hodgkin disease	82	1.9	1.35	1.46	1.35	1.57	0.10	0.12	0.08	0.15
Pancreas	55	1.3	1.08	1.35	1.22	1.47	0.04	0.12	0.06	0.17
Nasopharynx	61	1.4	1.04	1.29	1.18	1.41	0.08	0.10	0.06	0.14
Connective & soft tissue	50	1.2	0.96	1.02	0.91	1.12	0.07	0.09	0.05	0.12
Testis	57	1.3	0.96	0.91	0.83	0.99	0.07	0.07	0.05	0.08
Breast	57	1.3	0.95	1.28	1.17	1.39	0.09	0.10	0.06	0.14
Liver	44	1.0	0.85	1.07	0.96	1.18	0.05	0.09	0.04	0.13
Multiple myeloma	51	1.2	0.79	1.17	1.07	1.27	0.08	0.11	0.08	0.14
Bone	43	1.0	0.73	0.65	0.58	0.72	0.05	0.05	0.04	0.07
Kidney	42	1.0	0.70	0.83	0.74	0.91	0.05	0.07	0.04	0.10
Gallbladder	39	0.9	0.63	0.93	0.84	1.03	0.03	0.08	0.04	0.13
Lymphoid leukemia	37	0.9	0.60	0.75	0.66	0.83	0.04	0.07	0.03	0.10
Lip	29	0.7	0.56	0.80	0.70	0.89	0.03	0.05	0.00	0.10
Thyroid	27	0.6	0.49	0.55	0.48	0.62	0.04	0.05	0.03	0.07
Melanoma of skin	25	0.6	0.40	0.58	0.50	0.65	0.03	0.04	0.00	0.07
Tongue	22	0.5	0.36	0.51	0.44	0.58	0.03	0.04	0.02	0.07
Small intestine	20	0.5	0.34	0.47	0.40	0.54	0.03	0.04	0.01	0.07
Mouth	20	0.5	0.32	0.43	0.37	0.50	0.03	0.03	0.02	0.05
Myeloid leukemia	17	0.4	0.28	0.31	0.26	0.36	0.01	0.02	0.00	0.05
Nose, sinuses	16	0.4	0.25	0.30	0.25	0.35	0.03	0.03	0.02	0.04
Anus	14	0.3	0.22	0.29	0.24	0.34	0.02	0.02	0.00	0.04
Salivary glands	13	0.3	0.20	0.28	0.23	0.33	0.02	0.03	0.02	0.04
Hypopharynx	10	0.2	0.17	0.21	0.17	0.26	0.01	0.02	0.00	0.03
Other endocrine	9	0.2	0.14	0.15	0.12	0.19	0.01	0.01	0.01	0.02
Other thoracic organs	8	0.2	0.12	0.18	0.14	0.22	0.01	0.02	0.00	0.03
Pharynx unspecified	5	0.1	0.10	0.13	0.09	0.17	0.00	0.01	0.00	0.03
Kaposi sarcoma	6	0.1	0.09	0.13	0.10	0.16	0.01	0.02	0.01	0.02
Eye	4	0.1	0.06	0.06	0.04	0.08	0.00	0.00	0.00	0.01
Penis	3	0.1	0.05	0.05	0.03	0.07	0.01	0.01	0.00	0.01
Mesothelioma	2	0.0	0.03	0.04	0.02	0.05	0.00	0.00	0.00	0.01
Other male genitalia	1	0.0	0.02	0.02	0.01	0.04	0.00	0.00	0.00	0.01
Other urinary organs	1	0.0	0.02	0.02	0.01	0.04	0.00	0.00	0.00	0.01
Other oropharynx	1	0.0	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Other and unspecified	186	4.3	3.38	3.99	3.79	4.19	0.23	0.32	0.25	0.40
All sites	4754	0.0	81.15	105.01	104.00	106.01	5.11	7.75	7.30	8.21
All sites excluding skin	4347	100.0	74.17	95.95	94.99	96.92	4.65	7.04	6.61	7.48

* ASR=Age-standardized rate

In general, risk of cancer in women was lower than men in Mazandaran so that the cumulative rate was 6.3% for women by 69 years (Table 13). The majority of this risk was attributable to breast cancer (1.3% in 0–69 years) and upper GI cancers (esophagus 0.9%; stomach 0.7%).

Table 13. Cancer incidence rates in Mazandaran province, female

Sites	Cases (N)	Relative freq. (%)	Crude rate ($/10^5$)	ASR* ($/10^5$)	95% CI for ASR		Cumulative rate (%)		95% CI for cumulative rate 0–69 (%)	
							0–64	0–69		
Breast	690	22.1	11.45	14.01	13.66	14.36	1.16	1.28	1.21	1.36
Esophagus	436	14.0	7.12	10.78	10.46	11.11	0.61	0.91	0.78	1.03
Stomach	354	11.3	6.12	8.16	7.87	8.45	0.46	0.71	0.60	0.82
Other skin	280		4.64	6.75	6.49	7.01	0.38	0.51	0.41	0.62
Colon	173	5.5	2.88	3.88	3.69	4.07	0.27	0.34	0.28	0.39
Leukemia unspecified	110	3.5	1.84	2.00	1.87	2.13	0.10	0.13	0.08	0.17
Non-Hodgkin lymphoma	102	3.3	1.71	2.03	1.89	2.16	0.13	0.17	0.13	0.21
Brain, nervous system	99	3.2	1.60	1.83	1.71	1.95	0.14	0.15	0.12	0.18
Cervix uteri	96	3.1	1.55	2.33	2.18	2.48	0.17	0.21	0.16	0.26
Ovary	88	2.8	1.45	1.71	1.59	1.83	0.12	0.15	0.11	0.18
Rectum	75	2.4	1.21	1.60	1.48	1.72	0.12	0.13	0.09	0.17
Thyroid	65	2.1	1.04	1.21	1.11	1.30	0.09	0.10	0.08	0.12
Lung	53	1.7	0.96	1.33	1.22	1.45	0.06	0.09	0.04	0.14
Bladder	51	1.6	0.93	1.20	1.08	1.31	0.06	0.09	0.05	0.14
Pancreas	38	1.2	0.74	0.78	0.68	0.88	0.03	0.06	0.01	0.10
Hodgkin disease	46	1.5	0.74	0.75	0.68	0.83	0.06	0.06	0.05	0.07
Uterus unspecified	36	1.2	0.74	0.81	0.71	0.91	0.06	0.08	0.06	0.11
Corpus uteri	38	1.2	0.63	0.87	0.78	0.96	0.05	0.11	0.08	0.13
Gallbladder	33	1.1	0.54	0.72	0.64	0.80	0.05	0.06	0.04	0.09
Kidney	34	1.1	0.54	0.70	0.62	0.78	0.04	0.04	0.02	0.07
Multiple myeloma	30	1.0	0.51	0.73	0.64	0.81	0.05	0.07	0.04	0.09
Liver	25	0.8	0.48	0.56	0.48	0.63	0.02	0.04	0.01	0.07
Connective & soft tissue	28	0.9	0.46	0.59	0.52	0.67	0.04	0.06	0.04	0.07
Bone	30	1.0	0.46	0.55	0.49	0.62	0.02	0.03	0.00	0.06
Melanoma of skin	21	0.7	0.42	0.49	0.41	0.56	0.02	0.03	0.00	0.07
Nasopharynx	24	0.8	0.42	0.48	0.41	0.54	0.04	0.04	0.03	0.06
Larynx	23	0.7	0.39	0.51	0.44	0.58	0.04	0.04	0.03	0.06
Myeloid leukemia	21	0.7	0.36	0.41	0.35	0.47	0.03	0.03	0.02	0.05
Mouth	21	0.7	0.34	0.55	0.48	0.62	0.02	0.04	0.00	0.07
Salivary glands	16	0.5	0.30	0.31	0.26	0.37	0.03	0.03	0.02	0.04
Tongue	18	0.6	0.28	0.43	0.37	0.49	0.01	0.02	0.00	0.05
Lip	16	0.5	0.26	0.37	0.31	0.43	0.03	0.03	0.01	0.05
Hypopharynx	15	0.5	0.23	0.41	0.35	0.47	0.02	0.04	0.01	0.06
Lymphoid leukemia	14	0.4	0.23	0.31	0.26	0.36	0.02	0.02	0.00	0.05
Small intestine	13	0.4	0.20	0.33	0.27	0.38	0.02	0.03	0.01	0.05
Vagina	8	0.3	0.16	0.18	0.13	0.23	0.01	0.02	0.01	0.02
Eye	7	0.2	0.13	0.18	0.13	0.22	0.01	0.01	0.00	0.03
Nose, sinuses	8	0.3	0.12	0.15	0.11	0.18	0.01	0.01	0.00	0.02
Other thoracic organs	5	0.2	0.10	0.13	0.09	0.17	0.01	0.02	0.01	0.02
Pharynx unspecified	5	0.2	0.10	0.12	0.08	0.16	0.01	0.01	0.01	0.02
Vulva	5	0.2	0.08	0.11	0.08	0.15	0.01	0.01	0.01	0.02
Other endocrine	5	0.2	0.08	0.10	0.07	0.13	0.01	0.01	0.01	0.01
Anus	3	0.1	0.05	0.07	0.04	0.09	0.01	0.01	0.00	0.01
Tonsil	2	0.1	0.03	0.05	0.03	0.07	0.00	0.00	0.00	0.01
Other female genitalia	2	0.1	0.03	0.03	0.02	0.04	0.00	0.00	0.00	0.00
Mesothelioma	1	0.0	0.02	0.03	0.01	0.04	0.00	0.00	0.00	0.01
Adrenal gland	1	0.0	0.02	0.01	0.00	0.02	0.00	0.00	0.00	0.00
Other and unspecified	135	4.3	2.39	2.82	2.65	2.98	0.17	0.23	0.18	0.29
All sites	3399		56.91	74.39	73.55	75.23	4.85	6.28	5.99	6.56
All sites excluding skin	3119	100	52.27	67.63	66.83	68.43	4.47	5.76	5.50	6.03

* ASR=Age-standardized rate

5.3.3.4 Golestan

The leading cancer in men or women in terms of incidence in Golestan province was esophageal cancer (Figure 23). The second most common cancer was stomach in men and breast cancer in women (stomach, third leading cancer in women). Bladder and prostate were the third and fourth leading cancers in men while colon and cervix were the fourth and fifth most common cancers in Golestanian women. Lung was the ninth common cancer in men.

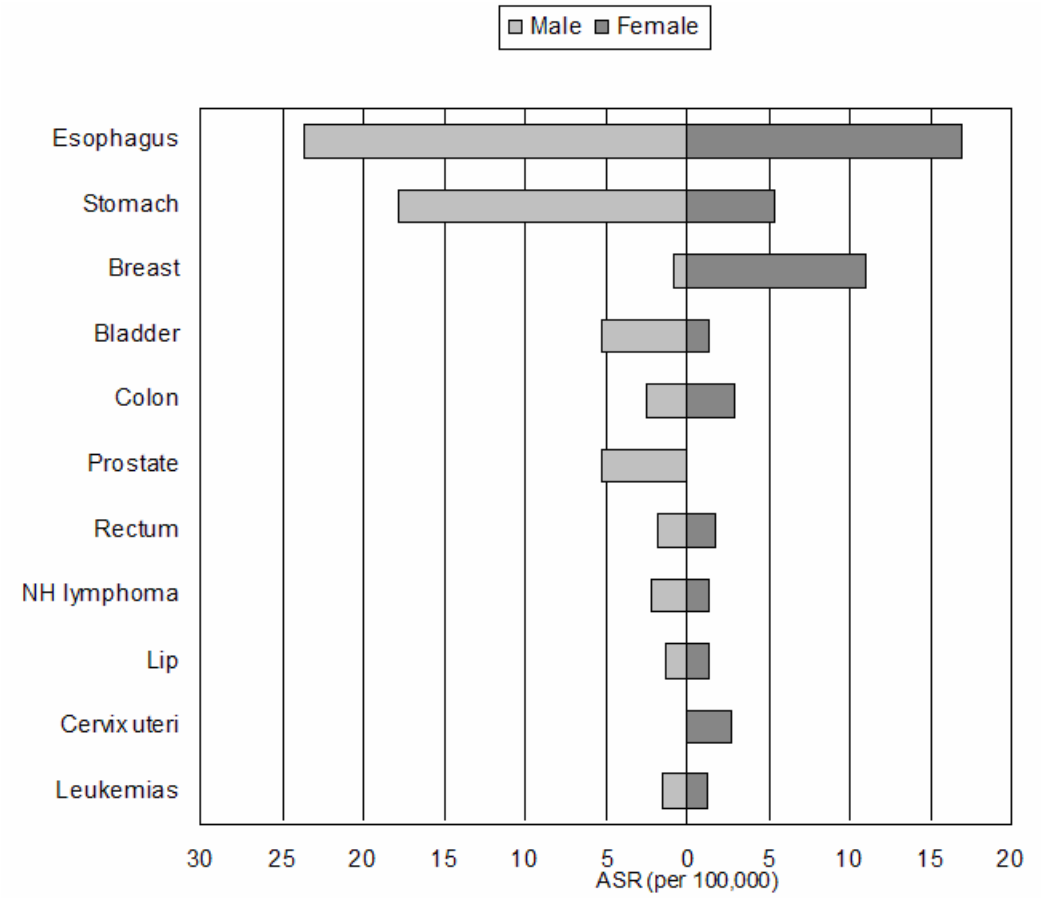

Figure 23. Age-standardized rate (ASR) in Golestan province by sex

In terms of age-specific rates of cancers in Golestanian men, esophageal cancer was the leading cancer after age 30 (Figure 24). Leukemia was the leading cancer before age 25 in boys followed by testis cancer for age 25–30 (Appendix Table 14). In females, leukemia was the most common cancer until age 15 followed by bone cancer (age15–19), breast (20–50) and esophageal cancer which was the leading cancer of elderly ages (Appendix Table 15 and Figure 25).

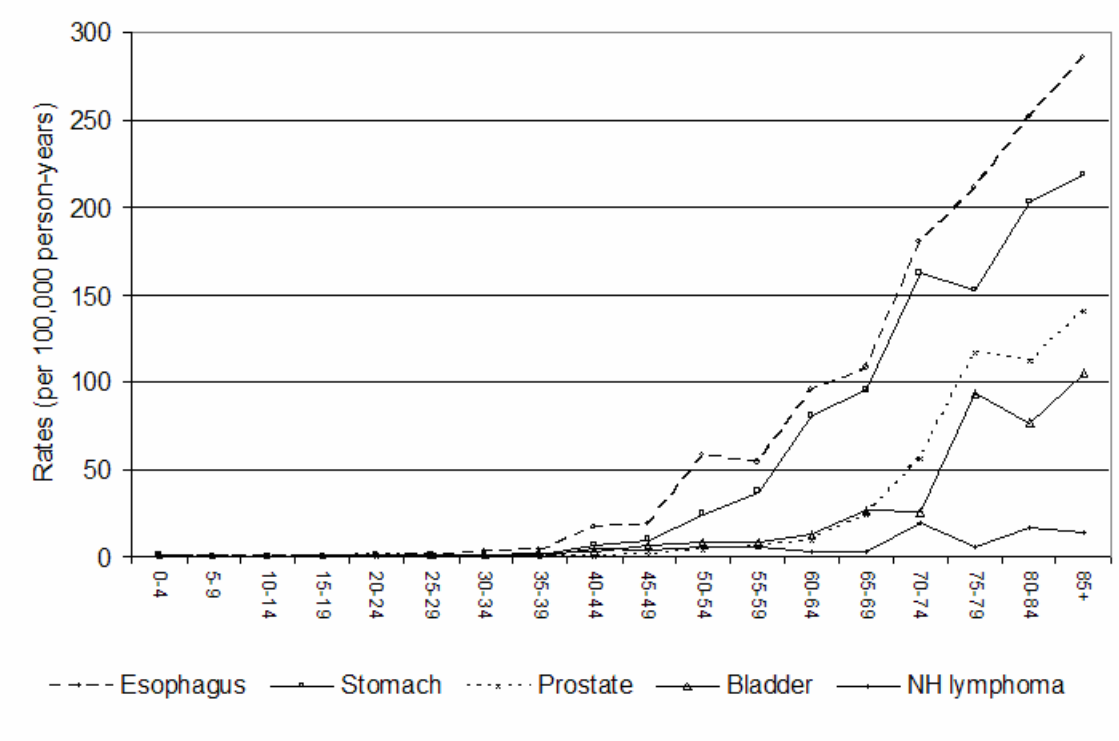

Figure 24. Age-specific incidence rate in Golestan, male

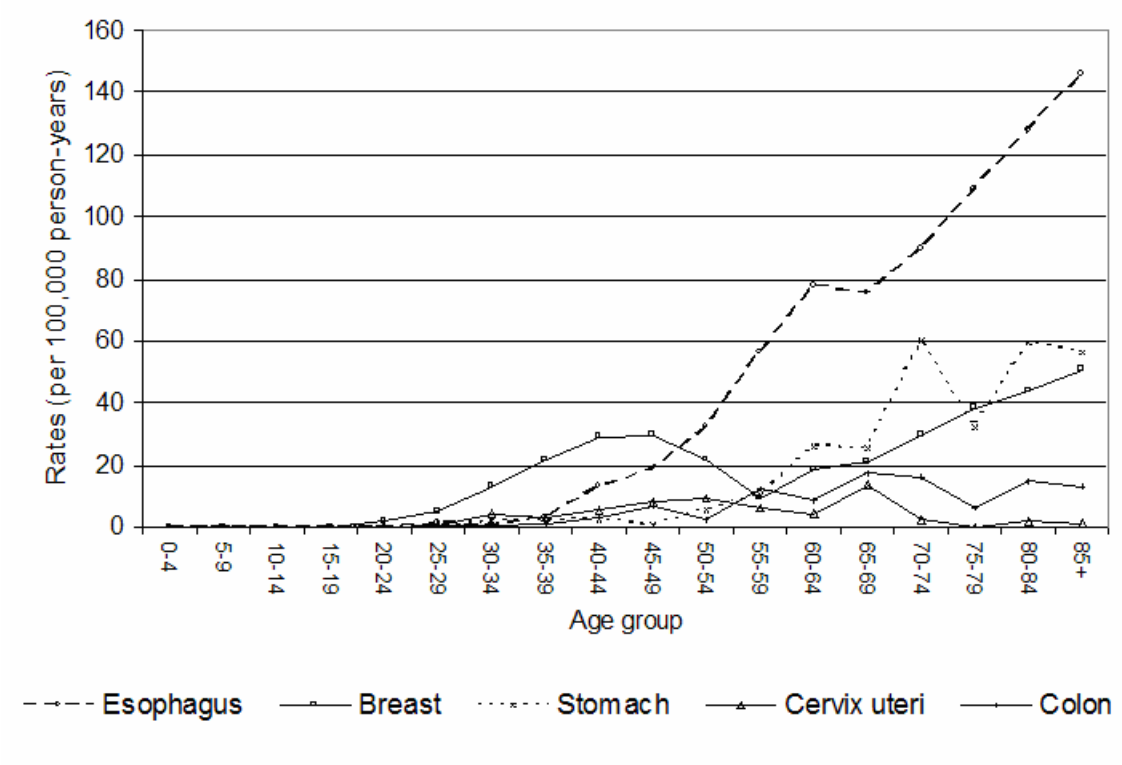

Figure 25. Age-specific incidence rate in Golestan, female

Considering cumulative rate, each man in Golestan province had about 6.2% risk of cancer by age 69 years (Table 14). Of this risk, the largest component was esophageal cancer (1.8% / 69 years) followed by stomach (1.35%), skin (0.8%), bladder (0.35%) and prostate (0.2%).

Table 14. Cancer incidence rates in Golestan province, male

Sites	Cases (N)	Relative freq. (%)	Crude rate (/10^5)	ASR* (/10^5)	95% CI for ASR		Cumulative rate (%)		95% CI for cumulative rate 0–69 (%)	
							0–64	0–69		
Esophagus	444	29.2	12.76	23.60	22.88	24.31	1.28	1.83	1.50	2.16
Stomach	338	22.3	9.87	17.78	17.17	18.40	0.86	1.35	1.06	1.65
Other skin	148		4.50	7.68	7.26	8.09	0.43	0.57	0.38	0.77
Prostate	95	6.3	2.73	5.36	5.01	5.71	0.11	0.23	0.01	0.46
Bladder	91	6.0	2.62	5.34	4.99	5.68	0.22	0.35	0.16	0.54
Non-Hodgkin lymphoma	53	3.5	1.52	2.27	2.06	2.47	0.14	0.16	0.08	0.23
Colon	47	3.1	1.48	2.48	2.24	2.72	0.12	0.15	0.02	0.28
Leukemia unspecified	41	2.7	1.28	1.14	1.01	1.27	0.06	0.06	0.00	0.12
Rectum	36	2.4	1.11	1.82	1.62	2.02	0.11	0.16	0.08	0.24
Lung	31	2.0	0.93	1.48	1.30	1.66	0.09	0.11	0.02	0.19
Lip	29	1.9	0.82	1.39	1.22	1.56	0.06	0.09	0.00	0.17
Brain, nervous system	27	1.8	0.82	0.95	0.82	1.07	0.06	0.09	0.06	0.11
Pancreas	23	1.5	0.68	1.25	1.08	1.41	0.06	0.08	0.00	0.16
Kidney	21	1.4	0.65	1.01	0.87	1.16	0.06	0.10	0.05	0.15
Hodgkin disease	20	1.3	0.63	0.71	0.60	0.82	0.05	0.05	0.00	0.10
Bone	17	1.1	0.54	0.64	0.53	0.75	0.05	0.06	0.03	0.08
Liver	19	1.3	0.53	0.93	0.79	1.06	0.06	0.09	0.05	0.13
Breast	17	1.1	0.48	0.86	0.73	1.00	0.05	0.06	0.00	0.12
Larynx	16	1.1	0.45	1.02	0.87	1.17	0.04	0.06	0.00	0.14
Testis	15	1.0	0.42	0.57	0.47	0.66	0.05	0.05	0.04	0.06
Thyroid	12	0.8	0.34	0.46	0.37	0.55	0.03	0.03	0.01	0.06
Multiple myeloma	9	0.6	0.33	0.62	0.49	0.76	0.03	0.04	0.00	0.12
Pharynx unspecified	11	0.7	0.31	0.54	0.44	0.65	0.01	0.05	0.02	0.09
Melanoma of skin	8	0.5	0.23	0.31	0.23	0.39	0.02	0.02	0.00	0.07
Myeloid leukemia	5	0.3	0.23	0.13	0.09	0.18	0.01	0.01	0.01	0.01
Mouth	4	0.3	0.11	0.14	0.09	0.19	0.01	0.01	0.00	0.03
Tonsil	3	0.2	0.08	0.18	0.12	0.24	0.01	0.01	0.00	0.05
Anus	3	0.2	0.08	0.18	0.11	0.24	0.02	0.02	0.01	0.03
Small intestine	3	0.2	0.08	0.12	0.07	0.16	0.01	0.01	0.00	0.03
Connective & soft tissue	3	0.2	0.08	0.09	0.05	0.13	0.01	0.01	0.00	0.01
Gallbladder	2	0.1	0.06	0.16	0.10	0.22	0.01	0.01	0.00	0.05
Lymphoid leukemia	2	0.1	0.06	0.16	0.10	0.22	0.00	0.00	0.00	0.05
Tongue	2	0.1	0.06	0.11	0.06	0.15	0.01	0.02	0.01	0.02
Hypopharynx	2	0.1	0.06	0.11	0.06	0.16	0.01	0.01	0.01	0.01
Nasopharynx	2	0.1	0.06	0.10	0.06	0.14	0.00	0.02	0.01	0.02
Penis	2	0.1	0.06	0.10	0.06	0.14	0.01	0.01	0.01	0.02
Kaposi sarcoma	2	0.1	0.06	0.09	0.05	0.13	0.01	0.01	0.00	0.01
Other thoracic organs	1	0.1	0.03	0.05	0.02	0.08	0.00	0.01	0.00	0.01
Nose, sinuses	1	0.1	0.03	0.03	0.01	0.04	0.00	0.00	0.00	0.00
Mesothelioma	1	0.1	0.03	0.03	0.01	0.05	0.00	0.00	0.00	0.00
Renal pelvis	1	0.1	0.03	0.03	0.01	0.05	0.00	0.00	0.00	0.00
Other and unspecified	60	3.9	1.72	2.78	2.55	3.02	0.16	0.18	0.06	0.30
All sites	1667		48.84	84.90	83.55	86.24	4.34	6.17	5.51	6.82
All sites excluding skin	1519	100.0	44.35	77.22	75.94	78.50	3.91	5.59	4.97	6.22

* ASR=Age-standardized rate

The risk of any cancer in women of Golestan was lower than men (5.7% / 69 years). The risk for esophageal cancer was highest (1.5%) followed by breast (0.9%), skin, stomach (0.4%) and cervix uteri (0.3%).

Table 15. Cancer incidence rates in Golestan province, female

Sites	Cases (N)	Relative freq. (%)	Crude rate (/10^5)	ASR* (/10^5)	95% CI for ASR		Cumulative rate (%)		95% CI for cumulative rate 0–69 (%)	
							0–64	0–69		
Esophagus	294	22.9	8.84	16.91	16.27	17.54	1.09	1.50	1.25	1.75
Breast	255	19.9	7.44	10.96	10.50	11.41	0.79	0.90	0.75	1.04
Other skin	107		3.08	5.92	5.56	6.29	0.35	0.44	0.28	0.59
Stomach	94	7.3	2.84	5.48	5.12	5.84	0.27	0.41	0.25	0.57
Cervix uteri	62	4.8	1.76	2.76	2.53	2.99	0.21	0.28	0.25	0.32
Colon	56	4.4	1.65	2.91	2.65	3.16	0.19	0.28	0.20	0.36
Ovary	52	4.0	1.54	2.12	1.92	2.32	0.18	0.20	0.17	0.23
Leukemia unspecified	40	3.1	1.24	1.12	0.99	1.25	0.08	0.08	0.07	0.09
Rectum	37	2.9	1.12	1.77	1.57	1.96	0.15	0.17	0.12	0.22
Thyroid	33	2.6	0.98	1.35	1.20	1.51	0.09	0.12	0.08	0.16
Non-Hodgkin lymphoma	35	2.7	0.98	1.30	1.15	1.45	0.09	0.09	0.03	0.15
Lip	26	2.0	0.76	1.39	1.21	1.56	0.09	0.12	0.06	0.19
Brain, nervous system	22	1.7	0.71	0.79	0.67	0.92	0.06	0.06	0.01	0.11
Uterus unspecified	23	1.8	0.70	1.02	0.88	1.16	0.08	0.10	0.09	0.12
Bladder	23	1.8	0.67	1.37	1.19	1.55	0.05	0.09	0.00	0.18
Hodgkin disease	17	1.3	0.50	0.56	0.46	0.65	0.05	0.05	0.04	0.06
Corpus uteri	16	1.2	0.48	0.99	0.84	1.15	0.05	0.07	0.00	0.15
Bone	14	1.1	0.42	0.52	0.42	0.62	0.03	0.04	0.00	0.09
Tongue	12	0.9	0.37	0.75	0.62	0.89	0.04	0.05	0.00	0.12
Lung	12	0.9	0.37	0.73	0.60	0.86	0.03	0.04	0.00	0.12
Kidney	13	1.0	0.36	0.59	0.48	0.70	0.05	0.06	0.05	0.07
Vagina	11	0.9	0.34	0.62	0.50	0.74	0.03	0.06	0.01	0.11
Gallbladder	11	0.9	0.31	0.69	0.56	0.81	0.02	0.03	0.00	0.11
Melanoma of skin	10	0.8	0.31	0.69	0.56	0.82	0.04	0.04	0.00	0.11
Pancreas	9	0.7	0.28	0.49	0.38	0.60	0.00	0.03	0.00	0.08
Mouth	9	0.7	0.25	0.60	0.48	0.72	0.02	0.04	0.00	0.10
Pharynx unspecified	8	0.6	0.22	0.44	0.34	0.54	0.02	0.04	0.00	0.07
Liver	7	0.5	0.20	0.39	0.30	0.48	0.03	0.03	0.00	0.06
Other thoracic organs	4	0.3	0.11	0.15	0.10	0.19	0.01	0.01	0.01	0.02
Multiple myeloma	2	0.2	0.11	0.06	0.02	0.10	0.00	0.00	0.00	0.01
Hypopharynx	3	0.2	0.08	0.18	0.12	0.24	0.01	0.01	0.00	0.04
Other female genitalia	3	0.2	0.08	0.18	0.12	0.24	0.02	0.02	0.02	0.03
Vulva	2	0.2	0.06	0.19	0.12	0.25	0.00	0.00	0.00	0.05
Larynx	2	0.2	0.06	0.13	0.07	0.18	0.00	0.01	0.00	0.03
Small intestine	2	0.2	0.06	0.09	0.05	0.14	0.00	0.00	0.00	0.02
Mesothelioma	2	0.2	0.06	0.05	0.03	0.07	0.00	0.00	0.00	0.00
Lymphoid leukemia	1	0.1	0.03	0.12	0.06	0.17	0.00	0.00	0.00	0.04
Connective & soft tissue	1	0.1	0.03	0.06	0.02	0.10	0.01	0.01	0.00	0.01
Ureter	1	0.1	0.03	0.06	0.02	0.09	0.00	0.01	0.00	0.00
Placenta	1	0.1	0.03	0.05	0.02	0.08	0.00	0.00	0.00	0.01
Kaposi sarcoma	1	0.1	0.03	0.04	0.01	0.06	0.00	0.00	0.00	0.01
Salivary glands	1	0.1	0.03	0.03	0.01	0.05	0.00	0.00	0.00	0.00
Myeloid leukemia	1	0.1	0.03	0.02	0.01	0.04	0.00	0.00	0.00	0.00
Other and unspecified	56	4.4	1.72	2.42	2.19	2.66	0.14	0.17	0.07	0.27
All sites	1391		41.19	69.05	67.83	70.28	4.39	5.68	5.21	6.15
All sites excluding skin	1284	100	38.12	63.11	61.94	64.28	4.04	5.24	4.80	5.68

* ASR=Age-standardized rate

5.3.3.5 Kerman

In Kerman province, the leading cancer in men was stomach (Figure 26). In women, breast cancer was the most common cancer followed by stomach, leukemia, colon, non-Hodgkin lymphoma, and lung. The second cancer in terms of ASR in men was lung followed by bladder, non-Hodgkin lymphoma and leukemia.

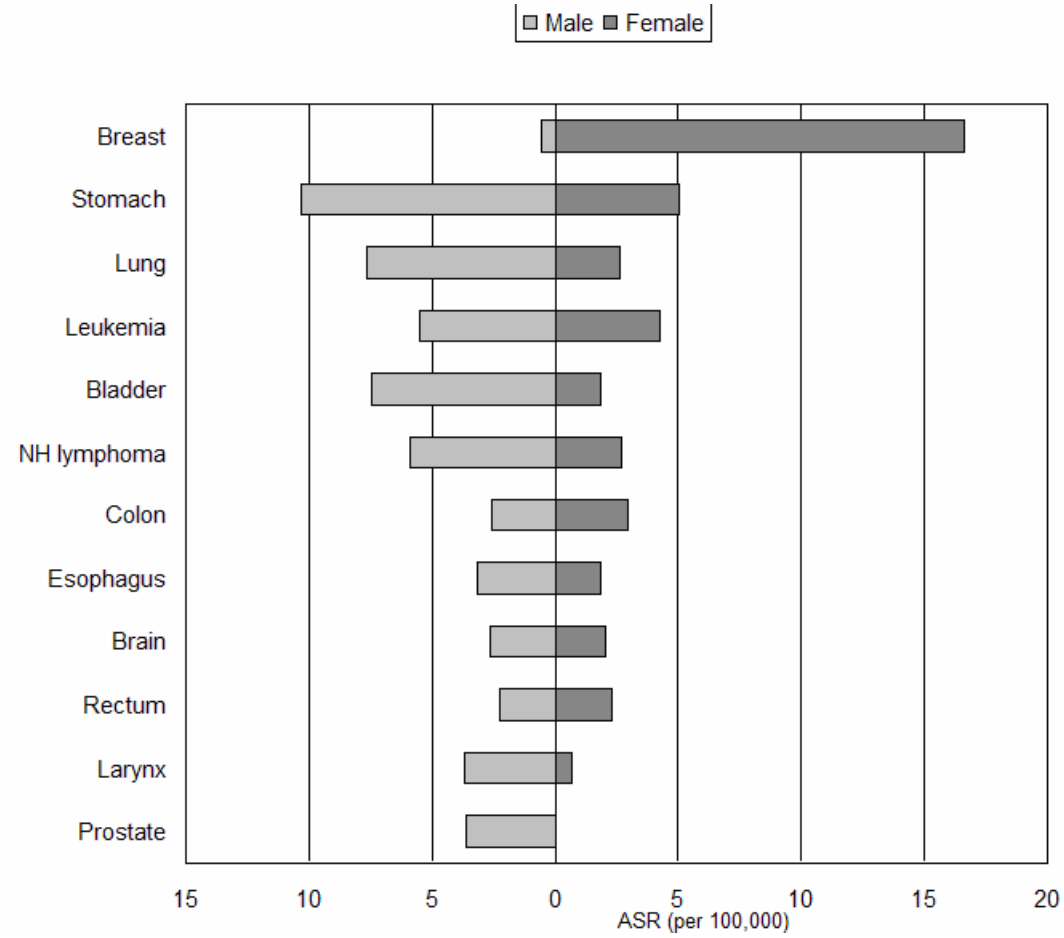

Figure 26. Age-standardized rate (ASR) in Kerman province by sex

Leukemia was the leading cancer of younger ages in men until age 35. Stomach was the most common cancer afterward except for two age periods 40–45 (larynx as leading cancer) and 50–55 (lung as leading cancer) (Figure 27 and Figure 28). The most common cancer in young girls in Kerman was the same as boys (leukemia) until age 25 when breast cancer started to increase dramatically in reproductive ages and remained the most common cancer for the rest of the life in Kermanian women.

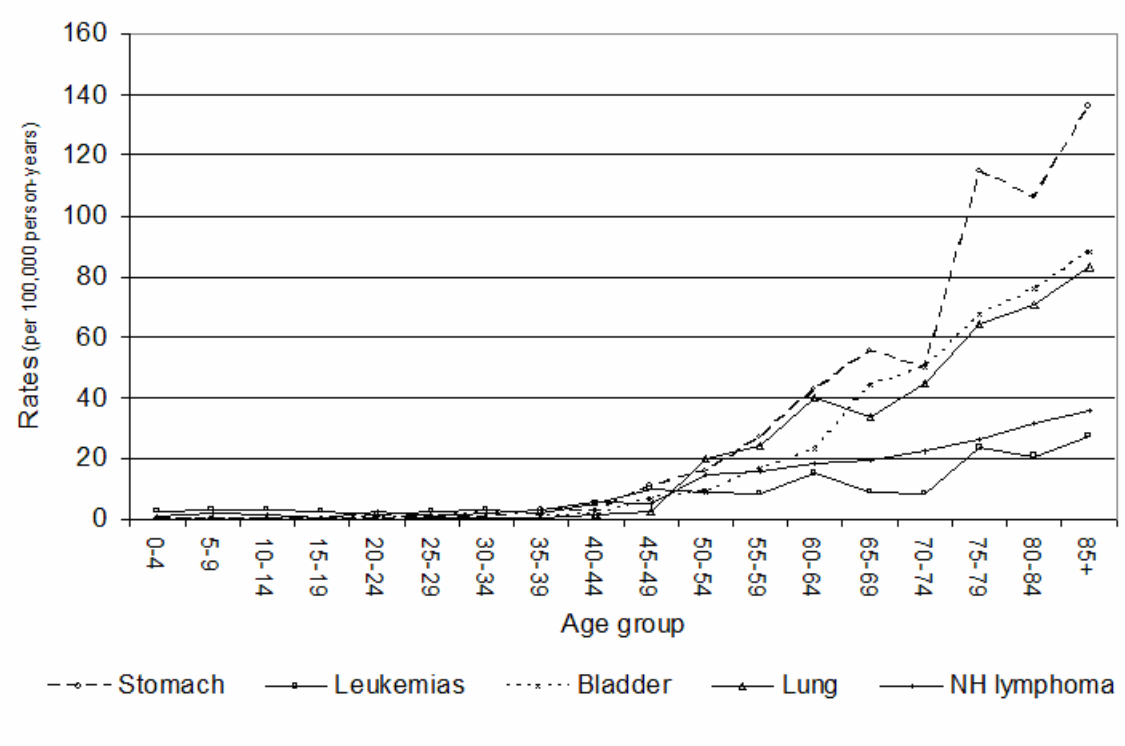

Figure 27. Age-specific incidence rate in Kerman, male

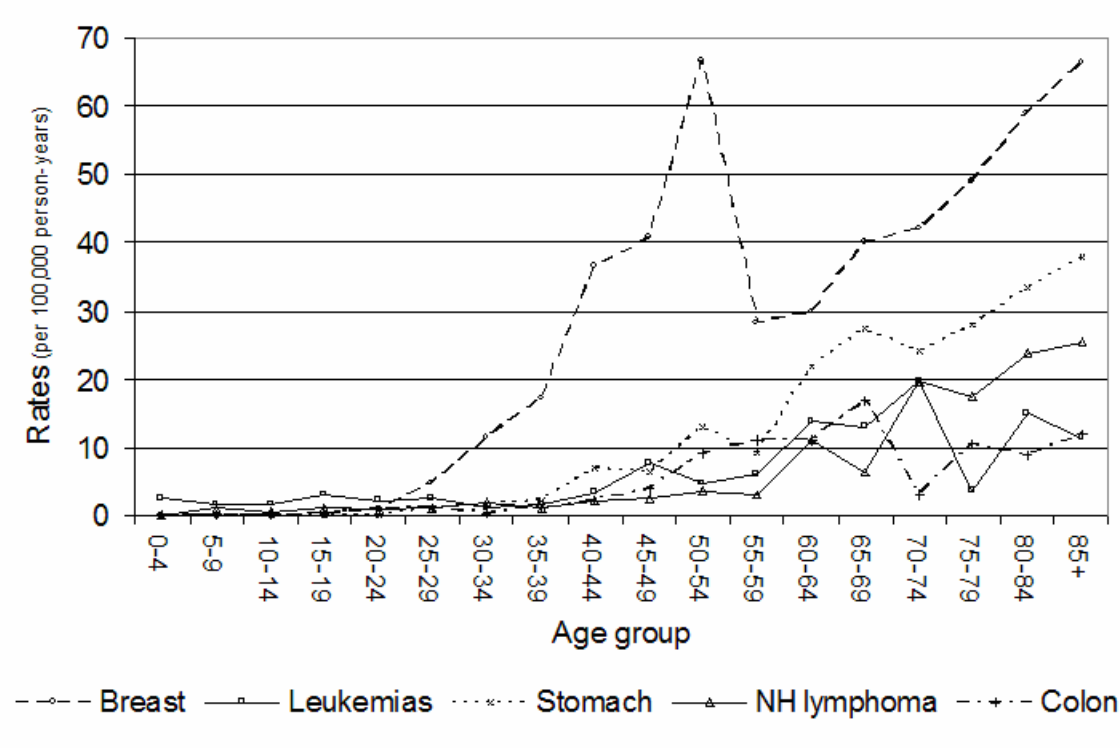

Figure 28. Age-specific incidence rate in Kerman, female

In terms of cumulative rate by 69 years of age, men in Kerman province had about 7.1% risk of any cancer (Table 16). Skin malignancy constituted most of this risk (1.1%) followed by stomach, lung, bladder, and non-Hodgkin lymphoma.

Table 16. Cancer incidence rates in Kerman province, male

Sites	Cases (N)	Relative freq. (%)	Crude rate (/10^5)	ASR* (/10^5)	95% CI for ASR		Cumulative rate (%)		95% CI for cumulative rate 0–69 (%)	
							0–64	0–69		
Other skin	411		8.78	13.27	12.84	13.71	0.69	0.99	0.81	1.17
Stomach	301	11.9	6.22	10.33	9.96	10.71	0.55	0.85	0.69	1.01
Bladder	221	8.7	4.82	7.48	7.15	7.80	0.35	0.60	0.46	0.73
Lung	212	8.4	4.35	7.62	7.29	7.95	0.47	0.65	0.52	0.78
Non-Hodgkin lymphoma	208	8.2	4.31	5.90	5.63	6.18	0.40	0.50	0.41	0.59
Leukemia unspecified	148	5.8	3.16	3.07	2.89	3.25	0.20	0.21	0.16	0.25
Prostate	113	4.5	2.61	3.64	3.41	3.87	0.10	0.21	0.09	0.33
Larynx	106	4.2	2.23	3.68	3.45	3.90	0.24	0.31	0.22	0.39
Esophagus	99	3.9	2.16	3.13	2.93	3.34	0.13	0.17	0.07	0.27
Brain, nervous system	96	3.8	1.97	2.64	2.45	2.82	0.20	0.24	0.19	0.28
Hodgkin disease	85	3.4	1.73	1.88	1.74	2.02	0.14	0.14	0.11	0.17
Colon	81	3.2	1.67	2.56	2.38	2.75	0.18	0.22	0.16	0.28
Rectum	68	2.7	1.44	2.26	2.09	2.44	0.17	0.22	0.16	0.27
Multiple myeloma	53	2.1	1.13	1.80	1.64	1.96	0.12	0.17	0.11	0.23
Bone	53	2.1	1.08	1.13	1.03	1.24	0.07	0.09	0.06	0.11
Lymphoid leukemia	52	2.1	1.06	1.68	1.53	1.83	0.11	0.14	0.09	0.20
Liver	49	1.9	1.00	1.66	1.52	1.81	0.09	0.11	0.04	0.17
Melanoma of skin	38	1.5	0.83	1.27	1.14	1.40	0.07	0.09	0.02	0.15
Pancreas	37	1.5	0.79	1.04	0.93	1.16	0.06	0.09	0.04	0.13
Testis	33	1.3	0.71	0.77	0.68	0.86	0.05	0.05	0.04	0.07
Kidney	33	1.3	0.69	0.95	0.84	1.06	0.05	0.09	0.07	0.11
Connective & soft tissue	31	1.2	0.67	0.76	0.67	0.86	0.05	0.07	0.05	0.08
Myeloid leukemia	27	1.1	0.60	0.76	0.65	0.86	0.07	0.07	0.06	0.08
Thyroid	26	1.0	0.58	0.84	0.73	0.94	0.04	0.05	0.00	0.10
Gallbladder	28	1.1	0.57	0.88	0.77	0.99	0.05	0.07	0.03	0.12
Other thoracic organs	27	1.1	0.55	0.79	0.69	0.88	0.06	0.08	0.04	0.11
Breast	18	0.7	0.40	0.57	0.47	0.66	0.05	0.05	0.02	0.08
Lip	20	0.8	0.39	0.66	0.57	0.76	0.03	0.05	0.01	0.09
Mouth	16	0.6	0.36	0.49	0.40	0.58	0.03	0.04	0.01	0.07
Salivary glands	16	0.6	0.34	0.47	0.40	0.55	0.04	0.05	0.04	0.06
Tongue	12	0.5	0.26	0.41	0.33	0.49	0.04	0.04	0.02	0.05
Small intestine	12	0.5	0.26	0.41	0.34	0.49	0.03	0.03	0.00	0.07
Eye	12	0.5	0.26	0.31	0.25	0.37	0.01	0.01	0.00	0.04
Nasopharynx	10	0.4	0.20	0.28	0.23	0.34	0.02	0.02	0.00	0.04
Anus	9	0.4	0.20	0.26	0.20	0.32	0.01	0.03	0.01	0.05
Hypopharynx	5	0.2	0.10	0.22	0.16	0.27	0.01	0.01	0.00	0.04
Tonsil	4	0.2	0.08	0.13	0.09	0.17	0.01	0.01	0.00	0.02
Penis	3	0.1	0.06	0.09	0.06	0.13	0.01	0.01	0.01	0.02
Kaposi sarcoma	3	0.1	0.06	0.08	0.05	0.11	0.01	0.01	0.01	0.01
Other urinary organs	2	0.1	0.04	0.06	0.04	0.09	0.00	0.01	0.00	0.02
Other endocrine	2	0.1	0.04	0.05	0.03	0.07	0.01	0.01	0.00	0.01
Adrenal gland	2	0.1	0.04	0.02	0.01	0.03	0.00	0.00	0.00	0.00
Nose, sinuses	1	0.0	0.02	0.05	0.03	0.08	0.00	0.00	0.00	0.02
Immunoproliferative	1	0.0	0.02	0.05	0.02	0.07	0.00	0.00	0.00	0.01
Pharynx unspecified	1	0.0	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other and unspecified	155	6.1	3.19	4.04	3.83	4.26	0.20	0.30	0.22	0.38
All sites	2941		62.03	90.48	89.38	91.59	5.22	7.13	6.70	7.55
All sites excluding skin	2530	100	53.25	77.22	76.21	78.23	4.53	6.13	5.74	6.52

* ASR=Age-standardized rate

The cumulative cancer risk in Kermanian women by 69 years was lower than in men (Table 17). Most of this risk was due to breast cancer (1.5%) followed by skin (1.1%), stomach (0.5%), leukemia (0.34%) and colon cancers (0.31%).

Table 17. Cancer incidence rates in Kerman province, female

Sites	Cases (N)	Relative freq. (%)	Crude rate (/10^5)	ASR* (/10^5)	95% CI for ASR		Cumulative rate (%)		95% CI for cumulative rate 0–69 (%)	
							0–64	0–69		
Breast	488	23.7	10.50	16.61	16.12	17.11	1.26	1.47	1.34	1.59
Other skin	330	0.0	7.36	12.29	11.85	12.73	0.73	1.01	0.84	1.17
Stomach	135	6.6	2.80	5.07	4.80	5.34	0.32	0.46	0.37	0.55
Leukemia unspecified	109	5.3	2.25	2.62	2.45	2.79	0.17	0.20	0.16	0.23
Non-Hodgkin lymphoma	91	4.4	1.89	2.72	2.53	2.91	0.16	0.19	0.12	0.26
Colon	84	4.1	1.83	2.98	2.77	3.20	0.22	0.31	0.26	0.37
Cervix uteri	83	4.0	1.75	3.02	2.80	3.23	0.24	0.27	0.22	0.33
Thyroid	79	3.8	1.73	2.49	2.30	2.67	0.17	0.21	0.15	0.26
Ovary	65	3.2	1.53	2.04	1.86	2.21	0.14	0.17	0.12	0.23
Brain, nervous system	72	3.5	1.48	2.02	1.86	2.18	0.16	0.18	0.15	0.21
Lung	69	3.3	1.44	2.62	2.42	2.81	0.12	0.20	0.13	0.28
Rectum	63	3.1	1.36	2.29	2.10	2.48	0.20	0.25	0.20	0.29
Bladder	49	2.4	1.22	1.83	1.64	2.01	0.13	0.16	0.10	0.23
Gallbladder	54	2.6	1.16	2.05	1.87	2.22	0.11	0.16	0.09	0.23
Esophagus	51	2.5	1.12	1.84	1.68	2.01	0.12	0.14	0.08	0.19
Hodgkin disease	44	2.1	0.91	0.81	0.73	0.90	0.06	0.06	0.05	0.07
Bone	37	1.8	0.79	0.59	0.52	0.66	0.04	0.04	0.03	0.04
Lymphoid leukemia	31	1.5	0.67	1.01	0.89	1.13	0.05	0.10	0.06	0.13
Connective & soft tissue	29	1.4	0.66	0.76	0.66	0.85	0.05	0.06	0.04	0.08
Multiple myeloma	29	1.4	0.63	1.03	0.90	1.16	0.08	0.10	0.06	0.14
Pancreas	26	1.3	0.53	0.96	0.84	1.07	0.03	0.07	0.01	0.12
Corpus uteri	20	1.0	0.51	0.75	0.63	0.87	0.05	0.09	0.08	0.11
Liver	24	1.2	0.49	0.88	0.77	0.99	0.06	0.06	0.02	0.11
Melanoma of skin	23	1.1	0.49	0.69	0.59	0.79	0.05	0.05	0.02	0.09
Kidney	20	1.0	0.45	0.55	0.46	0.63	0.03	0.05	0.03	0.07
Myeloid leukemia	20	1.0	0.43	0.60	0.51	0.68	0.04	0.04	0.01	0.07
Uterus unspecified	18	0.9	0.39	0.60	0.51	0.70	0.05	0.06	0.04	0.08
Larynx	16	0.8	0.32	0.67	0.57	0.77	0.04	0.06	0.02	0.09
Mouth	15	0.7	0.30	0.47	0.39	0.55	0.03	0.06	0.05	0.07
Tongue	10	0.5	0.29	0.34	0.26	0.42	0.03	0.03	0.01	0.05
Eye	14	0.7	0.28	0.52	0.44	0.61	0.02	0.03	0.00	0.07
Other thoracic organs	13	0.6	0.26	0.47	0.38	0.55	0.05	0.05	0.03	0.06
Small intestine	11	0.5	0.25	0.36	0.28	0.43	0.03	0.03	0.02	0.05
Salivary glands	10	0.5	0.25	0.33	0.26	0.41	0.02	0.02	0.00	0.05
Nasopharynx	10	0.5	0.25	0.32	0.24	0.39	0.02	0.03	0.02	0.04
Other female genitalia	10	0.5	0.20	0.33	0.26	0.40	0.02	0.03	0.02	0.05
Anus	8	0.4	0.16	0.24	0.18	0.30	0.02	0.02	0.01	0.04
Vulva	6	0.3	0.15	0.17	0.12	0.22	0.01	0.01	0.00	0.03
Lip	7	0.3	0.14	0.22	0.16	0.28	0.00	0.02	0.00	0.05
Nose, sinuses	3	0.1	0.09	0.12	0.07	0.17	0.01	0.01	0.00	0.03
Vagina	4	0.2	0.08	0.11	0.07	0.14	0.00	0.00	0.00	0.02
Other endocrine	2	0.1	0.08	0.08	0.03	0.13	0.00	0.01	0.00	0.02
Pharynx unspecified	2	0.1	0.04	0.07	0.04	0.10	0.00	0.01	0.00	0.01
Mesothelioma	2	0.1	0.04	0.04	0.02	0.06	0.00	0.00	0.00	0.00
Adrenal gland	2	0.1	0.04	0.04	0.02	0.06	0.00	0.00	0.00	0.00
Hypopharynx	1	0.0	0.02	0.04	0.01	0.06	0.00	0.00	0.00	0.01
Immunoproliferative	1	0.0	0.02	0.04	0.02	0.06	0.00	0.00	0.00	0.01
Other and unspecified	101	4.9	2.18	3.37	3.15	3.59	0.24	0.27	0.20	0.35
All sites	2391		51.69	79.93	78.85	81.01	5.40	6.84	6.51	7.18
All sites excluding skin	2061	100	44.34	67.69	66.70	68.67	4.66	5.84	5.55	6.13

* ASR=Age-standardized rate

5.3.4 Regional variations

One goal of this study was to assess the regional variation of cancer occurrence in different provinces of Iran. Among men, after excluding non-melanoma skin cancer, which was the most common cancer in Kerman, upper gastrointestinal tract cancers (stomach and esophagus) were the two leading cancer sites in terms of incidence (Figure 29). Stomach was constantly the most common cancer although its ASR had a wide range, very high in the northwest of Iran (Ardebil 54.8) with a gradual decrease throughout the Caspian coastline to the northeast of the country (Golestan 17.8) and a further decrease in the south (Kerman 10.3). In contrast, esophageal cancer, as the seventh cancer site in the south (Kerman 3.1), was the most common cancer in Golestan and its ASR decreased from east (23.6) to west (12.1) of Caspian Littoral but kept its rank (second) all along the coastline.

Cancer of the bladder was the third leading cancer among men in these provinces, but it was remarkably similar to lung cancer which preceded bladder in Ardebil, Mazandaran and especially Kerman (Figure 29). However, ASR of bladder and lung were rather similar in all geographical areas (ranging 5.3 to 9.3) except for Golestan with a lower lung cancer rate (1.5). Prostate cancer as fifth leading cancer had low variability between the regions (ranging 3.6 to 5.4) with the exception of a higher rate in Gilan province (8.6 per 100,000).

In men, colon cancer as the most common lower gastrointestinal tract cancer was the sixth common cancer, but colorectal cancer rate was higher than prostate (5.6) when combining colon (3.9) and rectum (2.3). However, it showed no considerable variation between provinces (Figure 29). The next common cancer after colon was non-Hodgkin lymphoma with a similar ASR in Northern provinces (2.3 – 3.3) but a difference in the south (ASR as high as 5.9). The same applied to leukemias (combined lymphoid leukemia, myeloid leukemia and leukemia unspecified). ASR of leukemia was comparable in Northern provinces (1.4 – 3.9), but higher in Kerman (5.9).

In men, the provinces with the highest incidence rate for some cancers were Ardebil for stomach cancer, Gilan for bladder cancer, Mazandaran for lung cancer, Golestan for esophageal cancer and Kerman for skin cancer and hematological neoplasms such as lymphoma or leukemia. In women, the provinces with highest incidence rate for some cancers were Ardebil for stomach cancer, Gilan for colon cancer, Mazandaran for cervical

cancer, Golestan for esophageal cancer and Kerman for breast, skin cancer and hematological neoplasms such as lymphoma or leukemia.

Breast cancer was the most common female cancer in these provinces but its rank was not stable among all five provinces. For instance, stomach cancer was preceding breast cancer in Ardebil and esophagus kept its first place in Golestan. ASR of breast cancer ranged from lowest in Ardebil (8.4) to highest in Kerman (16.6). In Ardebil excluding skin cancer, breast cancer was even less frequent than esophageal cancer. However, stomach cancer in women similar to men had a decreasing pattern from the west (28.5 in Ardebil) to the east (5.5 in Golestan) and south (5 in Kerman).

In brief, in terms of incidence among these five provinces, stomach cancer had the highest rate in Ardebil province in both sexes. Highest rate of esophageal cancer was in Golestan in both sexes. Breast cancer was highest among Kermanian women. Highest rate of bladder and prostate cancer was recorded for Gilanian men whereas Gilanian women had highest rate of colorectal cancer. Highest rate of lung cancer found among Mazandaranian men. Kermanian men had the highest rate of skin or hematological neoplasms such as leukemia or lymphoma.

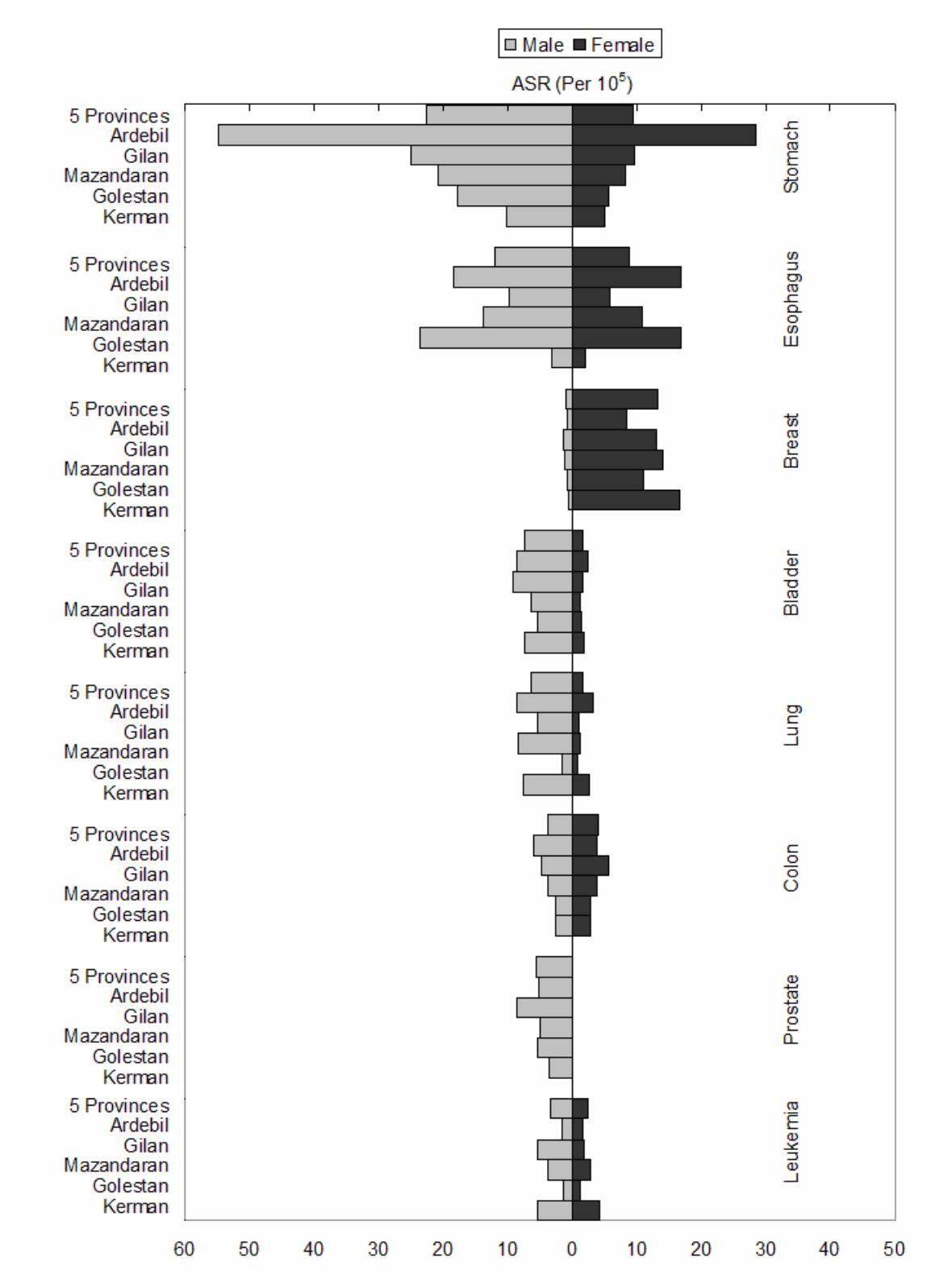

Figure 29. Provincial difference in age-standardized rate (ASR) by site and sex

Esophageal cancer in women did not have a similar pattern in men as its rate was high on both sides of the Caspian Sea (16.9 in Golestan and 16.7 in Ardebil) but its rate was medium in the middle of northern provinces (Gilan 5.9 and Mazandaran 10.8) and was exceptionally low in the south (Kerman 1.8). Colon with or without rectum was the fourth leading cancer in women and had no variation among any of the provinces.

Regarding incidence of all cancer sites together excluding non-melanoma skin in the five provinces, the average annual ASR was 93 per 100,000 men and 69 for 100,000 women. ASR of all sites in Ardebil (men 135.5; women 98.2) was higher than the average while other provinces had rather similar ASR (especially in women 63.1–67.6). In men, Gilan and Mazandaran were very similar (96–96.3) same to Golestan and Kerman (77.2). The difference for Ardebil was mostly due to the extremely high incidence of stomach cancer (55.8 compared to average 22.5).

5.3.5 Time trend

In general, the number of cases increased year by year significantly for all provinces and also for Gilan province alone (Figure 30 and Table 18).

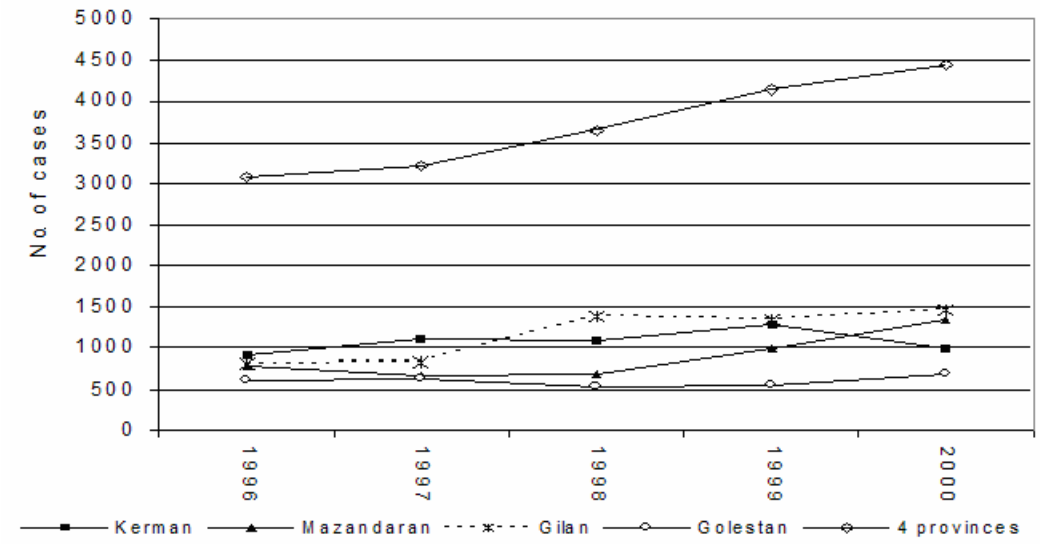

Figure 30. Changes in number of new cancer cases (all sites) by province and year of diagnosis

Table 18. Time trend analysis to test significance of annual increasing number of cases by province (using simple linear regression)

Province	Gilan		Mazandaran		Golestan		Kerman		4 provinces	
Slope coefficient	179.1		143.0		7.4		31.8		361.3	
95% CI	22.4	335.8	-49.9	335.9	-65.6	80.4	-121.6	185.2	251.9	470.7

Comparing slope of increase in number of cases by province revealed slower change in Golestan and Kerman provinces rather than two other provinces although they were not significant except for Gilan with a slope coefficient of 179 (95% CI: 22, 336) (Figure 25 and Table 18). Calculating the increase of cases in each year showed that on average there was about 10% increase in number of cases annually (increasing 361 cancer case per year, 95%CI: 252, 471). This means around 40% increase over 5 years, which was substantial and could not be real for all sites of cancers. It showed that the data in the last years of the study was more complete and should be closer to reality. The rates for the two last years (with lower under-registration) were not used as representative of the real situation because the ASRs calculated for 1999 and 2000 did not include Ardebil province at all (year of diagnosis was not reported for Ardebil) and these data, too, were based on only 75% of all cases from other provinces than Ardebil. Thus, ASRs for years could be more than 25% under-estimated.

The incidence of almost all major cancer sites in both sexes had a significant increase during the 5 years of this study (slope coefficient averagely 7; Figure 31, Figure 32 and Appendix Table 26). Stomach cancer increased more rapidly than esophagus in both sexes, although the slow increase for esophagus in women was not significant (coefficient=0.15, 95%CI = –0.19 – 0.48; Table 19). In women, breast cancer had a dramatic increase during these five years and was more than the average of other sites (slope=1.63, 95%CI=0.80 – 2.48; highly significant). This means that each year ASR of breast cancer increased 1.63.

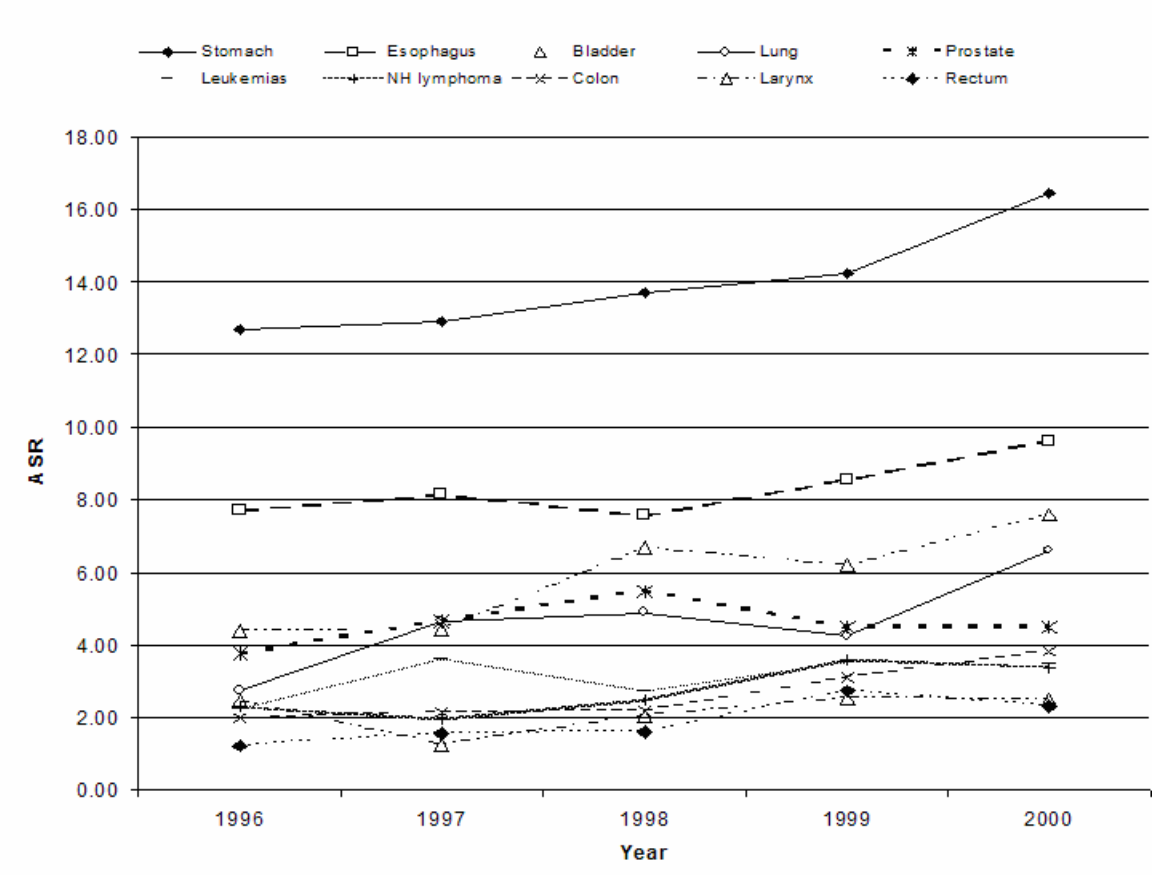

Figure 31. Changes in age standardized rate (ASR per 10^5) of 10 major cancers during the five years of the study, male

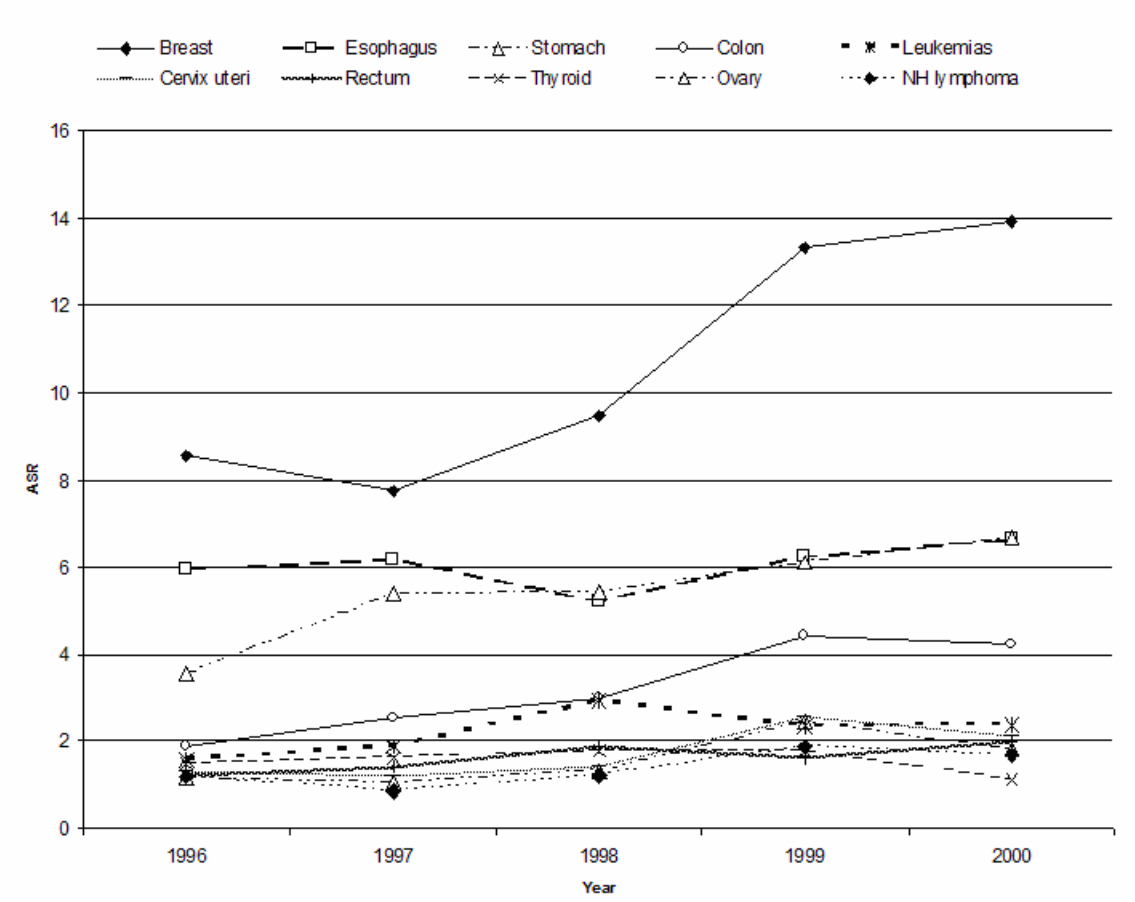

Figure 32. Changes in age-standardized rate (ASR per 10^5) of 10 major cancers during the five years of the study, female

Table 19. Time trend analysis for changes in age-standardized rate (ASR) during the five years of the study in four provinces by cancer site and sex (slope coefficient=annual change)

Male				Female			
Site	Slope Coefficient	95% CI		Site	Slope Coefficient	95% CI	
All sites	7.09	6.19	8.00	All sites	6.77	4.62	8.91
All sites excluding skin	6.17	5.39	6.94	All sites excluding skin	6.02	4.14	7.89
Other skin	0.92	0.58	1.26	Breast	1.63	0.80	2.46
Stomach	0.88	0.48	1.28	Other skin	0.75	0.46	1.04
Bladder	0.82	0.41	1.23	Stomach	0.69	0.40	0.99
Lung, trachea & bronchus	0.73	0.18	1.28	Colon	0.66	0.42	0.89
Colon	0.46	0.25	0.67	Cervix uteri	0.30	0.05	0.55
Esophagus	0.42	0.08	0.76	Ovary	0.27	0.00	0.54
Other and unspecified	0.41	0.11	0.71	Leukemias together	0.21	-0.08	0.49
Non-Hodgkin lymphoma	0.38	0.12	0.65	Non-Hodgkin lymphoma	0.20	0.02	0.39
Rectum	0.34	0.11	0.56	Uterus unspecified	0.18	0.10	0.27
Leukemia unspecified	0.29	0.14	0.43	Other and unspecified	0.18	0.09	0.27
Leukemias together	0.25	-0.09	0.58	Rectum	0.17	0.06	0.29
Multiple myeloma	0.18	0.03	0.34	Bladder	0.17	0.04	0.29
Kidney	0.18	0.01	0.35	Leukemia unspecified	0.16	0.02	0.30
Other thoracic organs	0.15	0.06	0.25	Esophagus	0.15	-0.19	0.48
Testis	0.15	0.01	0.28	Multiple myeloma	0.15	0.07	0.22
Larynx	0.13	-0.21	0.48	Liver	0.13	0.03	0.24
Pancreas	0.13	-0.10	0.36	Pancreas	0.13	0.04	0.22
Prostate	0.13	-0.28	0.54	Hodgkin disease	0.13	0.01	0.24
Lip	0.09	-0.09	0.26	Lung, trachea & bronchus	0.12	-0.12	0.35
Mouth	0.08	-0.02	0.18	Kidney	0.11	0.07	0.16
Bone	0.07	-0.01	0.15	Nasopharynx	0.09	0.03	0.15
Brain, nervous system	0.07	-0.08	0.23	Melanoma of skin	0.08	0.00	0.16
Hodgkin disease	0.06	0.02	0.10	Lymphoid Leukemia	0.05	-0.05	0.16
Nasopharynx	0.05	0.00	0.11	Corpus uteri	0.05	-0.03	0.12
Liver	0.04	-0.09	0.17	Salivary glands	0.05	-0.02	0.11
Gallbladder	0.04	-0.02	0.09	Tongue	0.04	-0.08	0.15
Hypopharynx	0.03	0.00	0.05	Vagina	0.04	0.00	0.07
Kaposi sarcoma	0.02	-0.02	0.05	Larynx	0.03	0.01	0.06
Myeloid Leukemia	0.02	-0.02	0.05	Mouth	0.03	-0.05	0.12
Thyroid	0.01	-0.12	0.14	Small intestine	0.03	-0.01	0.08
Renal pelvis	0.01	0.00	0.02	Eye	0.03	-0.02	0.08
Eye	0.01	-0.03	0.05	Hypopharynx	0.03	-0.03	0.09
Other male genitalia	0.01	0.00	0.02	Vulva	0.02	-0.02	0.07
Breast	0.00	-0.16	0.16	Connective & soft tissue	0.02	-0.18	0.22
Tongue	0.00	-0.05	0.05	Kaposi sarcoma	0.02	0.01	0.04
Small intestine	0.00	-0.05	0.05	Bone	0.01	-0.13	0.15
Nose, sinuses	0.00	-0.07	0.07	Nose, sinuses	0.01	-0.02	0.04
Other female genitalia	0.00	0.00	0.00	Other thoracic organs	0.01	-0.05	0.07
Adrenal gland	0.00	-0.01	0.01	Placenta	0.01	0.00	0.02
Ureter	0.00	0.00	0.00	Mesothelioma	0.01	-0.02	0.03
Placenta	0.00	0.00	0.00	Anus	0.01	-0.02	0.03
Vulva	0.00	0.00	0.00	Testis	0.00	0.00	0.00
Vagina	0.00	0.00	0.00	Prostate	0.00	0.00	0.00
Corpus uteri	0.00	0.00	0.00	Renal pelvis	0.00	0.00	0.00
Uterus unspecified	0.00	0.00	0.00	Other male genitalia	0.00	0.00	0.00
Ovary	0.00	0.00	0.00	Ureter	0.00	-0.01	0.01
Cervix uteri	0.00	0.00	0.00	Penis	0.00	0.00	0.00
Penis	0.00	-0.04	0.03	Other urinary organs	0.00	0.00	0.00
Other urinary organs	0.00	-0.02	0.01	Other oropharynx	0.00	0.00	0.00
Mesothelioma	0.00	-0.02	0.01	Tonsil	0.00	-0.02	0.02
Connective & soft tissue	-0.01	-0.17	0.16	Pharynx unspecified	0.00	-0.03	0.03
Other oropharynx	-0.01	-0.02	0.00	Gallbladder	0.00	-0.14	0.13
Immunoproliferative	-0.01	-0.02	0.00	Other endocrine	0.00	-0.04	0.03
Pharynx unspecified	-0.02	-0.06	0.03	Immunoproliferative	0.00	-0.02	0.01
Tonsil	-0.02	-0.03	-0.01	Adrenal gland	-0.01	-0.03	0.01
Salivary glands	-0.03	-0.06	0.01	Myeloid Leukemia	-0.01	-0.07	0.06
Anus	-0.03	-0.13	0.06	Lip	-0.02	-0.12	0.09
Melanoma of skin	-0.03	-0.12	0.05	Other female genitalia	-0.02	-0.04	0.00
Other endocrine	-0.04	-0.06	-0.01	Brain, nervous system	-0.05	-0.27	0.16
Lymphoid Leukemia	-0.06	-0.25	0.13	Thyroid	-0.06	-0.24	0.12

5.3.5.1 Corrected incidence trends using relative age-standardized ratio

Using adjusted relative age-standardized rate for trend analysis showed that there were slight changes in incidence of cancers annually as expected for this short period of time, but the annual change shown in the incidence of these cancers were not statistically significant (Table 20).

Table 20. Time trend analysis of adjusted relative age-standardized rate (ARASR per 10^5) by calendar year, site and sex (slope coefficient=annual change)

Site	Male								Female							
	ARASR					Slope coefficient	95% CI		ARASR					Slope coefficient	95% CI	
	1996	1997	1998	1999	2000				1996	1997	1998	1999	2000			
Stomach	17.23	10.93	15.30	12.20	14.32	-0.45	-2.17	1.26	4.96	6.28	4.05	5.74	6.12	0.18	-0.45	0.81
Esophagus	10.47	6.92	8.45	7.35	8.38	-0.38	-1.26	0.51	7.96	6.93	3.76	5.65	5.87	-0.55	-1.48	0.39
Breast	0.59	0.41	1.03	0.56	0.32	-0.04	-0.23	0.15	11.83	8.98	7.03	12.43	12.72	0.52	-1.16	2.20
Other skin	7.46	4.94	8.94	7.24	7.72	0.28	-0.71	1.27	6.06	5.26	3.81	6.39	6.36	0.17	-0.58	0.93
Bladder	5.99	3.76	7.48	5.36	6.65	0.29	-0.66	1.24	1.16	1.09	1.15	1.24	1.36	0.06	0.01	0.10
Colon	2.75	1.87	2.50	2.72	3.41	0.22	-0.09	0.53	2.64	3.00	2.26	4.20	3.93	0.38	-0.03	0.79
Other and unspecified	3.69	1.88	3.97	2.82	3.68	0.09	-0.51	0.70	2.78	2.34	1.58	2.18	2.50	-0.07	-0.38	0.24
Lung	3.81	4.07	5.62	3.74	5.92	0.39	-0.22	1.00	1.01	1.89	0.75	1.09	1.41	0.00	-0.31	0.31
NH lymphoma	3.13	1.67	2.83	3.10	2.97	0.11	-0.31	0.53	1.64	0.99	0.91	1.76	1.54	0.06	-0.21	0.33
Prostate	5.09	3.94	6.08	3.84	3.89	-0.25	-0.90	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rectum	1.73	1.38	1.84	2.42	2.10	0.18	-0.01	0.37	1.69	1.67	1.40	1.52	1.83	0.01	-0.11	0.13
Brain, nervous system	1.95	1.10	1.46	1.63	1.30	-0.08	-0.29	0.14	2.15	1.01	0.98	1.39	0.90	-0.21	-0.49	0.07
Thyroid	0.69	0.36	0.80	0.23	0.56	-0.04	-0.20	0.12	2.04	1.85	1.30	1.63	1.02	-0.23	-0.37	-0.08
Larynx	3.26	1.06	2.24	2.12	2.14	-0.12	-0.66	0.42	0.42	0.31	0.28	0.38	0.37	0.00	-0.04	0.04
Cervix uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.79	1.39	1.06	2.39	1.94	0.13	-0.21	0.47
Ovary	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.59	1.22	0.99	2.28	1.66	0.12	-0.21	0.45
Pancreas	0.78	1.37	1.21	1.06	1.25	0.06	-0.08	0.21	0.49	0.79	0.35	0.71	0.87	0.07	-0.07	0.20
Liver	1.23	0.76	1.50	1.00	0.86	-0.05	-0.25	0.16	0.60	0.30	0.59	0.65	0.82	0.08	-0.02	0.18
Kidney	0.71	0.57	1.42	1.19	0.93	0.11	-0.11	0.32	0.52	0.59	0.52	0.78	0.73	0.06	0.01	0.11
Hodgkin disease	1.25	0.79	1.24	0.98	0.96	-0.04	-0.17	0.09	0.67	0.24	0.34	0.65	0.79	0.07	-0.09	0.22
Gallbladder	0.62	0.34	0.38	0.43	0.51	-0.01	-0.09	0.06	1.08	1.18	0.68	1.08	0.63	-0.10	-0.24	0.04
Multiple myeloma	0.83	0.83	1.54	0.83	1.35	0.11	-0.11	0.32	0.23	0.59	0.30	0.71	0.72	0.11	0.00	0.22
Bone	0.84	0.36	0.75	0.73	0.67	0.00	-0.13	0.13	0.82	0.33	0.15	0.35	0.56	-0.05	-0.23	0.13
Lip	0.79	0.54	0.42	0.40	0.97	0.02	-0.15	0.20	0.73	0.19	0.19	0.30	0.34	-0.07	-0.21	0.07
Connective & soft tissue	0.95	0.22	0.19	0.44	0.47	-0.07	-0.28	0.13	0.50	0.39	0.68	0.12	0.53	-0.02	-0.17	0.13
Corpus uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.94	0.68	0.49	0.87	0.68	-0.03	-0.16	0.09
Melanoma of skin	0.57	0.58	0.46	0.43	0.30	-0.07	-0.09	-0.05	0.40	0.24	0.45	0.45	0.50	0.04	-0.01	0.10
Uterus unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.26	0.48	0.80	0.94	0.14	0.02	0.25
Mouth	0.09	0.32	0.30	0.15	0.51	0.07	-0.02	0.16	0.42	0.34	0.36	0.19	0.47	0.00	-0.08	0.07
Small intestine	0.47	0.43	0.40	0.41	0.32	-0.03	-0.05	-0.02	0.22	0.23	0.07	0.26	0.26	0.01	-0.04	0.06
Nasopharynx	0.46	0.26	0.54	0.51	0.40	0.01	-0.06	0.09	0.09	0.00	0.25	0.25	0.40	0.09	0.03	0.14
Testis	0.71	0.26	0.61	0.91	0.79	0.08	-0.07	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tongue	0.31	0.08	0.08	0.19	0.15	-0.02	-0.08	0.04	0.57	0.16	0.11	0.30	0.46	-0.01	-0.15	0.13
Other thoracic organs	0.13	0.14	0.23	0.29	0.74	0.14	0.05	0.23	0.07	0.26	0.17	0.24	0.08	0.00	-0.06	0.06
Salivary glands	0.38	0.11	0.19	0.16	0.11	-0.05	-0.11	0.01	0.10	0.16	0.03	0.32	0.18	0.03	-0.03	0.10
Hypopharynx	0.08	0.07	0.22	0.12	0.14	0.02	-0.02	0.06	0.12	0.12	0.13	0.31	0.11	0.02	-0.04	0.07
Vagina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.20	0.12	0.29	0.29	0.01	-0.04	0.06
Pharynx unspecified	0.18	0.25	0.16	0.15	0.09	-0.03	-0.05	0.00	0.17	0.09	0.13	0.13	0.08	-0.02	-0.04	0.01
Eye	0.10	0.02	0.17	0.14	0.04	0.00	-0.04	0.04	0.10	0.18	0.14	0.30	0.13	0.02	-0.03	0.07
Anus	0.14	0.12	0.39	0.04	0.00	-0.04	-0.14	0.06	0.06	0.15	0.03	0.10	0.07	0.00	-0.04	0.03
Nose, sinuses	0.09	0.03	0.26	0.12	0.01	-0.01	-0.08	0.06	0.00	0.06	0.10	0.04	0.07	0.01	-0.01	0.03
Other female genitalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.13	0.06	0.06	0.08	-0.04	-0.07	0.00
Other endocrine	0.21	0.05	0.02	0.01	0.02	-0.04	-0.08	-0.01	0.12	0.00	0.07	0.08	0.02	-0.01	-0.04	0.02
Kaposi sarcoma	0.05	0.11	0.09	0.17	0.09	0.01	-0.01	0.04	0.00	0.00	0.07	0.08	0.07	0.02	0.01	0.04
Vulva	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.07	0.21	0.04	0.02	-0.02	0.07
Tonsil	0.13	0.04	0.07	0.03	0.00	-0.03	-0.04	-0.01	0.00	0.05	0.00	0.04	0.00	0.00	-0.02	0.02
Mesothelioma	0.03	0.00	0.05	0.00	0.00	-0.01	-0.02	0.01	0.06	0.05	0.02	0.00	0.09	0.00	-0.02	0.03
Penis	0.04	0.07	0.00	0.10	0.00	-0.01	-0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Adrenal gland	0.00	0.00	0.03	0.00	0.00	0.00	-0.01	0.01	0.00	0.08	0.02	0.00	0.00	-0.01	-0.03	0.01
Immunoproliferative	0.05	0.00	0.00	0.00	0.00	-0.01	-0.02	0.00	0.00	0.05	0.00	0.00	0.00	0.00	-0.02	0.01
Other urinary organs	0.00	0.03	0.04	0.00	0.00	0.00	-0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Placenta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01	0.00	0.02
Other oropharynx	0.04	0.00	0.00	0.00	0.00	-0.01	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Renal pelvis	0.00	0.00	0.00	0.00	0.05	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ureter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	-0.01	0.01
Other male genitalia	0.00	0.00	0.00	0.00	0.04	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
All sites	83.33	55.88	84.60	69.28	78.11	0.30	-8.22	8.81	62.44	54.41	40.56	63.04	62.67	0.91	-5.94	7.76
All sites excluding skin	75.87	50.93	75.66	62.04	70.39	0.01	-7.56	7.59	56.37	49.16	36.75	56.66	56.30	0.74	-5.36	6.83

Gender-specific trends showed a slight decrease in stomach, esophagus and prostate and slight increase in bladder, lung and stability in non-Hodgkin lymphoma in men while in women breast, colon, stomach and cervical cancers were increasing and there was a decline in incidence of esophageal and thyroid cancer (Figure 33 and Figure 34).

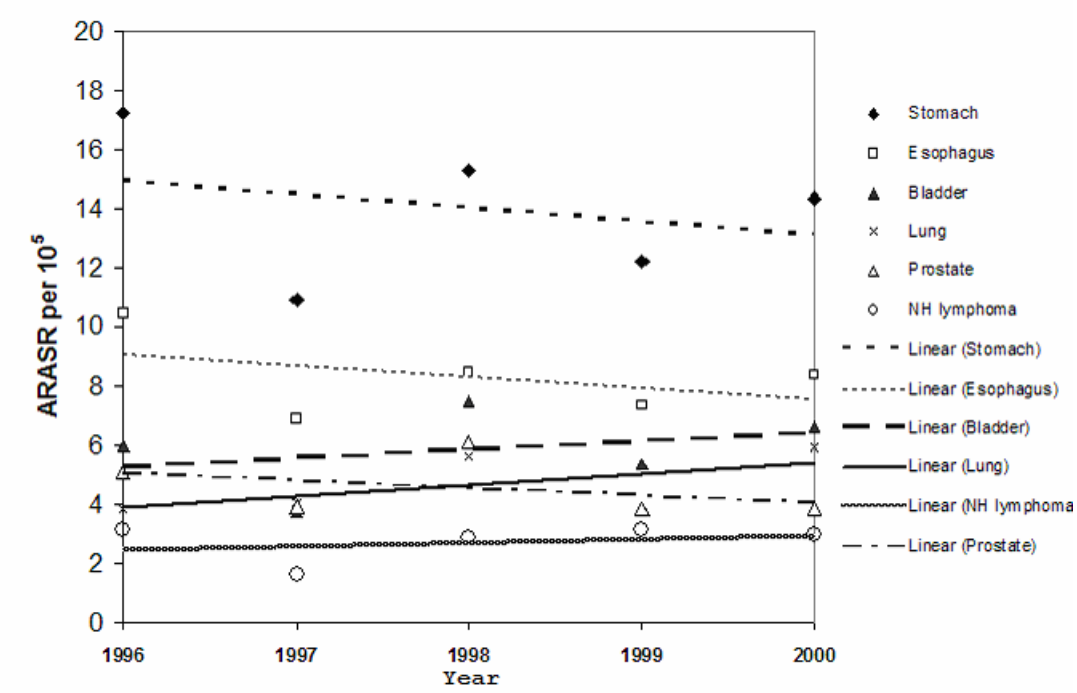

Figure 33. Time trend of adjusted relative age-standardized rate (ARASR per 10^5) for leading cancers, male, 1996–2000

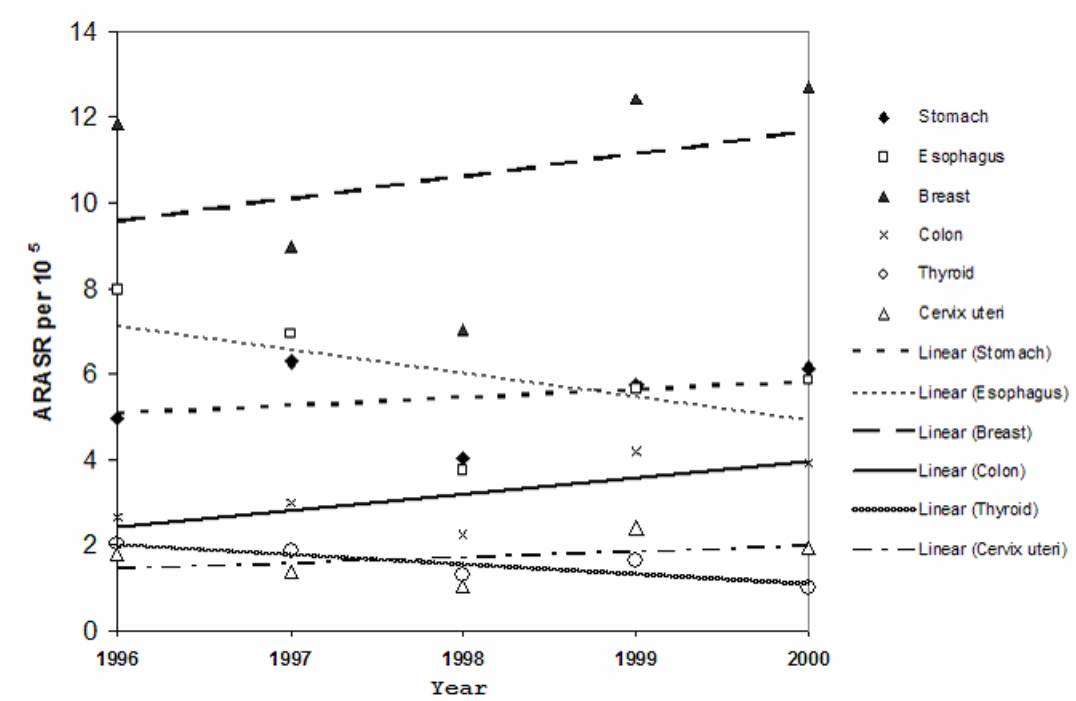

Figure 34. Time trend of adjusted relative age-standardized rate (ARASR per 10^5) for leading cancers, female, 1996–2000

Calculating ARASR using mean ASR of men and women for each cancer in each year provided an estimate for the time trend for incidence of each cancer including the slope and confidence interval (Table 21).

Table 21. Time trend analysis of adjusted relative age-standardized rate (ARASR per 10^5) by calendar year and site

Site	Both sexes							
	ARASR					Slope coefficient	95% CI	
	1996	1997	1998	1999	2000			
Stomach	11.27	8.83	8.93	9.14	10.39	-0.14	-0.89	0.60
Esophagus	9.34	6.84	5.90	6.58	7.22	-0.45	-1.23	0.33
Other skin	6.86	5.03	6.16	6.89	7.14	0.24	-0.31	0.79
Breast	6.27	4.01	4.89	6.32	6.47	0.27	-0.45	0.99
Bladder	3.64	2.60	3.86	3.41	4.11	0.17	-0.19	0.54
Lung, trachea & bronchus	2.46	3.12	2.82	2.49	3.76	0.20	-0.11	0.51
Colon	2.72	2.31	2.47	3.44	3.69	0.31	0.04	0.57
Prostate	2.60	2.25	2.55	2.01	2.01	-0.14	-0.26	-0.02
Non-Hodgkin lymphoma	2.41	1.36	1.75	2.46	2.29	0.09	-0.24	0.42
Rectum	1.72	1.47	1.64	1.98	1.97	0.10	0.00	0.21
Brain, nervous system	2.06	1.04	1.22	1.51	1.11	-0.14	-0.39	0.11
Larynx	1.87	0.73	1.11	1.29	1.28	-0.06	-0.35	0.22
Thyroid	1.38	0.99	1.16	0.91	0.80	-0.13	-0.21	-0.04
Pancreas	0.64	1.11	0.72	0.90	1.07	0.06	-0.06	0.19
Cervix uteri	0.91	0.58	0.67	1.16	0.96	0.07	-0.08	0.22
Liver	0.93	0.56	1.00	0.84	0.84	0.01	-0.11	0.13
Kidney	0.63	0.58	0.93	1.01	0.84	0.09	-0.01	0.18
Multiple myeloma	0.54	0.73	0.85	0.79	1.07	0.11	0.06	0.16
Hodgkin disease	0.97	0.55	0.73	0.83	0.88	0.01	-0.11	0.12
Ovary	0.80	0.51	0.63	1.11	0.82	0.06	-0.08	0.21
Gallbladder	0.86	0.69	0.59	0.75	0.58	-0.05	-0.11	0.01
Bone	0.85	0.35	0.41	0.55	0.63	-0.02	-0.16	0.12
Lip	0.77	0.38	0.29	0.35	0.65	-0.03	-0.17	0.12
Connective & soft tissue	0.72	0.27	0.47	0.29	0.49	-0.05	-0.17	0.07
Melanoma of skin	0.48	0.42	0.47	0.43	0.39	-0.02	-0.03	0.00
Corpus uteri	0.48	0.29	0.31	0.42	0.34	-0.01	-0.07	0.04
Testis	0.36	0.15	0.25	0.47	0.40	0.04	-0.04	0.12
Nasopharynx	0.28	0.15	0.37	0.38	0.39	0.05	-0.01	0.10
Mouth	0.26	0.32	0.35	0.16	0.49	0.03	-0.05	0.11
Small intestine	0.35	0.34	0.21	0.34	0.29	-0.01	-0.05	0.03
Uterus unspecified	0.26	0.11	0.30	0.38	0.46	0.07	0.01	0.12
Tongue	0.44	0.12	0.11	0.24	0.30	-0.02	-0.11	0.08
Other thoracic organs	0.10	0.19	0.20	0.27	0.42	0.07	0.05	0.10
Salivary glands	0.25	0.13	0.10	0.24	0.15	-0.01	-0.06	0.04
Pharynx unspecified	0.18	0.17	0.15	0.14	0.09	-0.02	-0.03	-0.01
Hypopharynx	0.10	0.09	0.17	0.21	0.13	0.02	-0.01	0.05
Eye	0.10	0.09	0.16	0.22	0.09	0.01	-0.03	0.05
Vagina	0.14	0.09	0.08	0.14	0.14	0.01	-0.02	0.03
Anus	0.11	0.14	0.19	0.07	0.04	-0.02	-0.06	0.01
Nose, sinuses	0.05	0.04	0.18	0.09	0.04	0.00	-0.04	0.04
Kaposi sarcoma	0.03	0.06	0.07	0.12	0.08	0.02	0.00	0.03
Other endocrine	0.16	0.03	0.05	0.04	0.02	-0.03	-0.05	0.00
Other female genitalia	0.12	0.05	0.04	0.03	0.04	-0.02	-0.03	0.00
Tonsil	0.07	0.05	0.03	0.03	0.00	-0.02	-0.02	-0.01
Vulva	0.00	0.02	0.04	0.10	0.02	0.01	-0.01	0.04
Mesothelioma	0.05	0.02	0.04	0.00	0.05	0.00	-0.02	0.01
Penis	0.02	0.03	0.00	0.05	0.00	0.00	-0.02	0.01
Adrenal gland	0.00	0.03	0.02	0.00	0.00	0.00	-0.01	0.01
Immunoproliferative	0.03	0.02	0.00	0.00	0.00	-0.01	-0.01	0.00
Other urinary organs	0.00	0.02	0.02	0.00	0.00	0.00	-0.01	0.00
Renal pelvis	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01
Placenta	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01
Ureter	0.00	0.00	0.02	0.00	0.00	0.00	-0.01	0.01
Other male genitalia	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01
Other oropharynx	0.02	0.00	0.00	0.00	0.00	0.00	-0.01	0.00
Other and unspecified	3.29	2.06	2.67	2.54	3.15	0.02	-0.33	0.37
All sites	73.80	54.56	60.92	66.68	71.19	0.69	-4.83	6.22
All sites excluding skin	66.92	49.53	54.76	59.80	64.05	0.45	-4.54	5.44

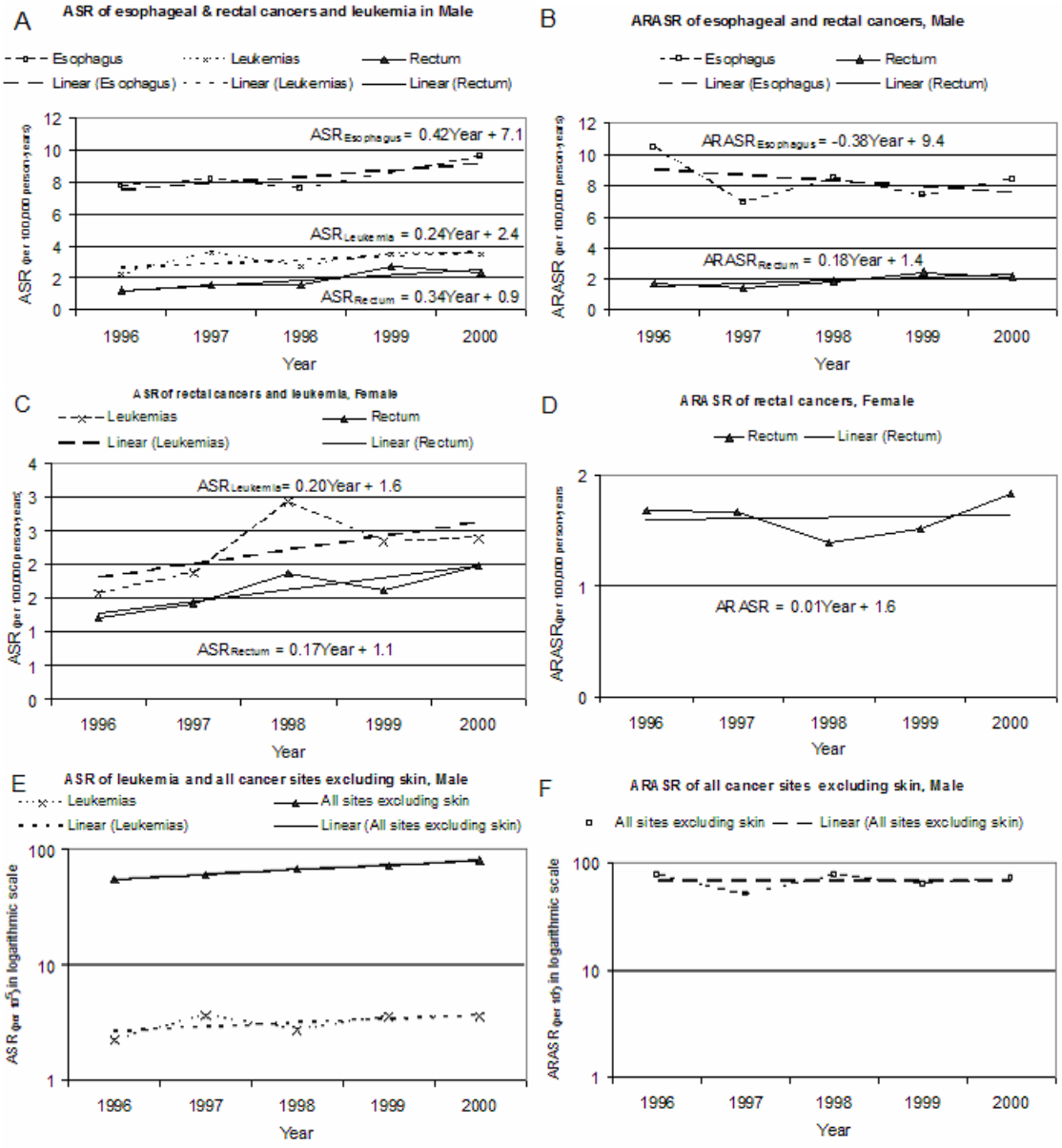

Figure 35. Comparison of trend in age-standardized rate (ASR per 10^5) and adjusted relative age-standardized rate (ARASR per 10^5) of some selected cancers

ASR of all three cancers (leukemia, esophageal and rectal cancer in male) increased in the five years of registration (1996–2000; Part A, Figure 35). However, ARASR of esophageal cancer did not show any increase, it was annually decreasing 0.38 per 100,000 persons (Part B). In the same parts, comparing slope of change in ASR and ARASR of rectal cancer in men showed that both ASR and ARASR of rectal cancer were increasing, but the slope of increase in ARASR was around half of the slope for ASR. ASR of rectal cancer in

women (Part C in Figure 35) increased 0.17 per 10^5 each year and the shape and slope of trend was very similar to those of leukemia. However, ARASR of rectal cancer in women in Part D showed almost no change over time, which seemed more realistic for this short period of time. The same happened to "All sites excluding skin" in men (compare Part E and F in Figure 35).

In general, trends of RASR and ARASR are similar with the difference that their Y axis scale is different and ARASR is closer to ASR.

5.3.5.2 Comparison between past and present

The only comparable information available for the incidence of cancers in the past is results of an effort to find out the esophageal cancer incidence in the Caspian Littoral part of Iran in the 1960's. Compared to 3–4 decades ago, the incidence of esophageal cancer declined to approximately two thirds of its previous level in both women and men (Figure 36). On the other hand, incidence of all cancer sites during this 25–31 year period of time increased substantially (54% increase in men and 63% in women, Figure 36).

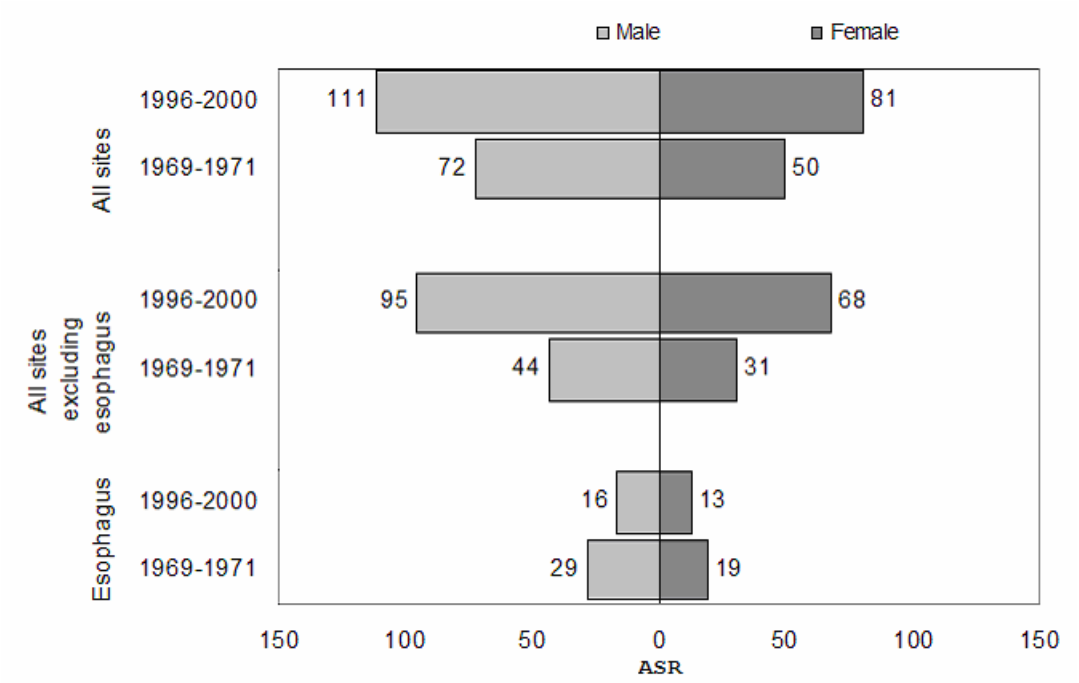

Figure 36. Age-standardized rate (ASR per 10^5) in the four northern provinces of Ardebil, Gilan, Mazandaran and Golestan, comparison between 1969–71 and 1996–2000

5.3.6 Cancer burden prediction for year 2010

Based on information from the United Nations, the population of Iran is predicted to increase from 60,055,488 in 1996 to 74,282,000 in 2010 (23.7% growth). With the assumption of no change in the risk factors of cancer from 1996 to 2010 and therefore a constant incidence rate during this period of time, the number of cases will increase due to population growth alone (column "Without any adjustment" in Table 23, Table 24 and Table 25). In addition, over this 10–15 year period of time, the age structure of population will change so that the proportion of older age groups will increase (Figure 5 and Figure 37). Thus, the incidence for 2010 should be adjusted for the age structure in that year. Adjustment for age will affect (mostly increase) the annual number of new cases (column "Only age adjusted" in Table 23, Table 24 and Table 25). Ignoring the change in incidence of cancers, it is estimated that in the year 2010, there will be 47,059 new cancer cases for all cancer sites excluding skin whereas mean annual new cancer cases in 1996–2000 was 32,320 (45.6% increase after 10–15 years; Table 25). Half of this increase will be due to increase in population over time (23.7%) and the other half will be because of ageing in the population. The increase in annual number of new cancer cases during this 10–15 years will be different among women and men so that women will have more incident cancer cases in 2010 (women 58.5% vs. men 36.5%).

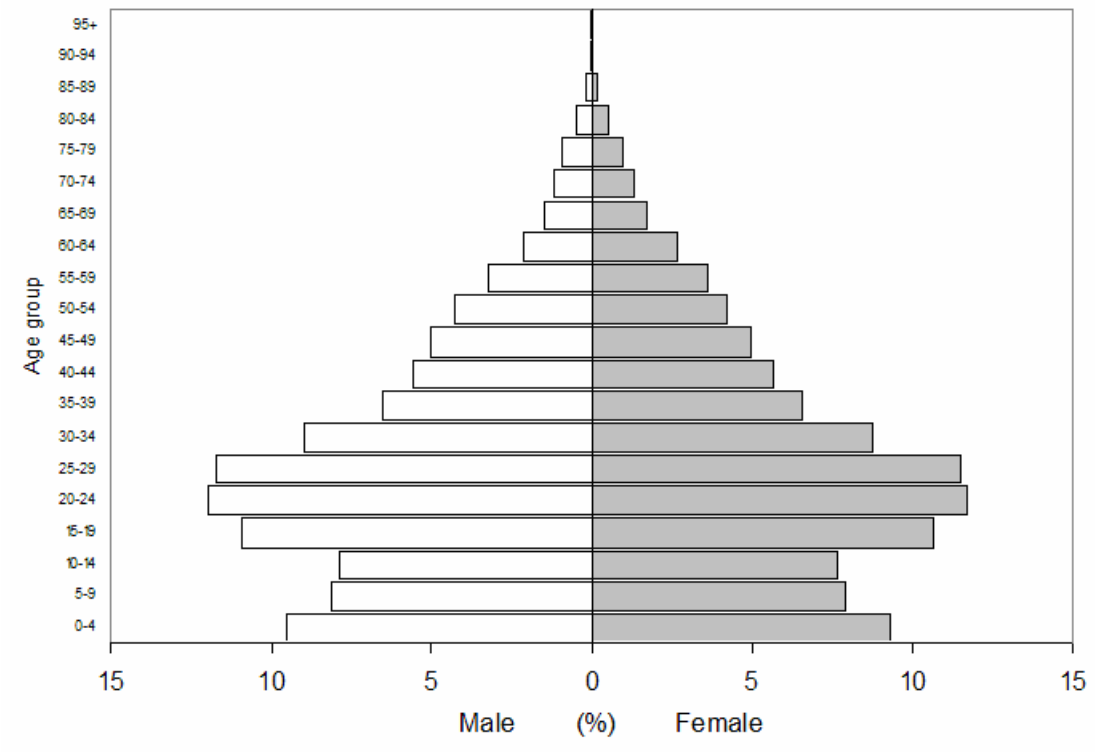

Figure 37. Population pyramid for Iran 2010

The annual number of new cancer cases will increase from 1996 to 2010 for all leading cancers (Figure 38). In general, the increase will be greater in women than men with the largest amount in breast cancer. The percent of increase for each cancer is shown in Table 23, Table 24 and Table 25.

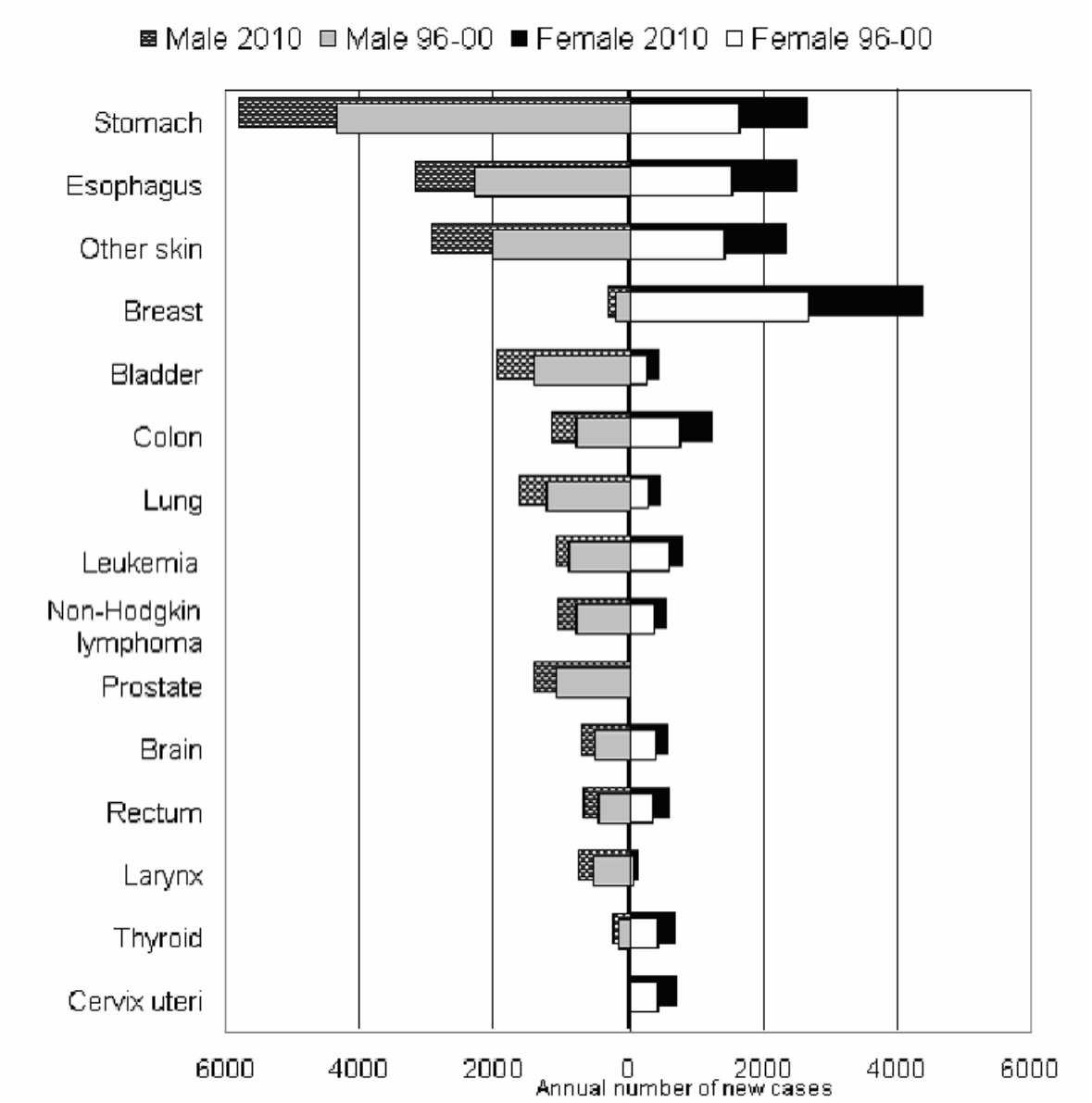

Figure 38. Annual number of new cases in 1996–2000 and predicted for 2010 by sex

Table 22 shows the results of projected adjusted relative age-standardized rate for year 2010 which approximates ASR in 2010. Based on this projection, the ranking of leading cancers will change over 10–15 years from 1996. For instance, esophageal cancer will decrease whereas breast cancer will increase substantially.

Table 22. Projected adjusted relative age-standardized rate (ARASR per 10^5) for year 2010 as alternative for age-standardized rate (ASR) in 2010

Site	Male	Site	Female
Bladder	9.35	Breast	15.18
Lung	9.29	Colon	8.19
Stomach	8.54	Stomach	6.63
Colon	5.26	Lung	2.68
NH lymphoma	4.09	Rectum	2.51
Rectum	4.05	Bladder	2.46
Esophagus	3.80	Cervix uteri	1.41
Prostate	1.58	NH lymphoma	1.06
All sites	77.79	All sites	68.09
All sites excluding skin	67.15	All sites excluding skin	61.26

Considering change in the incidence rate of cancers from 1996 to 2000 using annual changes in adjusted relative age-standardized rate as an approximation of change in incidence, incidence rates in the year 2010 will change, so that the number of new cases will change accordingly (column “Final” in Table 23, Table 24 and Table 25). The predicted number of cases has been adjusted for change in age structure of population, population growth and change in incidence rate during this 10–15 year period of time. The number of new cases in 2010 will increase by around 50% in men and about 100% in women. The total number of new cases, excluding non-melanoma skin cancer in 2010, will be more than 53,000 (about 28,000 men and 25,000 women).

Table 23. Estimated number of new cases and incidence rate for Iran in year 1996 and 2010 by cancer site, male

Site	1996–2000					2010					Increase (%)
	Incidence rate		Total no. of new cases (5 Provinces, 5 years)	Annual no. of new cases (Iran)		Incidence rate		No. of new cases			
	Crude 5 provinces	Age-adjusted for Iran age structure		Not adjusted for Iran age structure	Age-adjusted for Iran age structure	Age-adjusted for Iran age structure 2010	Final*	Without any adjustment for age structure	Age-adjusted for Iran age structure 2010	Final*	
Stomach	15.80	14.21	3432	4537	4332	15.45	9.99	5940	5809	3756	-13.3
Esophagus	8.36	7.62	1835	2426	2323	8.44	3.93	3143	3172	1476	-36.4
Other skin	7.44	6.66	1593	2106	2031	7.8	11.17	2799	2934	4201	106.8
Bladder	5.28	4.73	1137	1503	1441	5.27	8.77	1986	1982	3299	128.9
Lung	4.52	4.07	984	1301	1241	4.41	9.08	1701	1656	3412	175.0
Prostate	4.80	3.57	855	1130	1089	3.81	0.82	1805	1431	309	-71.6
Other and unspecified	3.58	3.24	769	1017	989	3.6	4.69	1346	1355	1765	78.5
Colon	2.90	2.61	622	823	795	3.06	5.66	1091	1149	2129	167.8
Non-Hodgkin lymphoma	2.76	2.56	605	800	782	2.86	4.21	1036	1076	1585	102.6
Leukemia unspecified	2.36	2.20	509	673	672	2.07	3.45	886	778	1298	93.1
Larynx	2.06	1.81	435	576	552	2.05	0.62	776	769	233	-57.8
Brain, nervous system	1.82	1.70	399	528	517	1.91	1.00	684	717	375	-27.5
Rectum	1.71	1.51	359	475	460	1.8	3.96	643	677	1488	223.5
Hodgkin disease	1.13	1.06	246	325	323	1.19	0.71	425	447	268	-16.9
Liver	0.99	0.87	210	278	267	0.98	0.39	373	370	147	-45.0
Pancreas	1.02	0.84	203	268	256	0.91	1.67	384	342	629	145.7
Kidney	0.93	0.84	201	266	257	0.9	2.17	349	337	817	218.0
Bone	0.90	0.84	197	260	257	0.92	0.96	338	345	361	40.5
Testis	0.89	0.84	194	256	256	1.07	2.02	335	401	759	196.6
Multiple myeloma	0.81	0.73	176	232	222	0.82	2.09	305	310	786	254.1
Breast	0.73	0.67	160	212	205	0.85	0.37	275	319	138	-32.5
Lip	0.55	0.50	121	160	154	0.58	0.86	207	217	322	109.4
Lymphoid leukemia	0.54	0.50	119	158	153	0.54	0.00	203	202	0	-100.0
Thyroid	0.58	0.49	116	153	150	0.61	0.13	219	229	47	-68.6
Connective & soft tissue	0.57	0.48	114	151	147	0.56	0.00	214	209	0	-100.0
Nasopharynx	0.48	0.44	104	138	134	0.52	0.68	180	197	257	92.0
Melanoma of skin	0.43	0.40	95	125	121	0.44	0.00	163	167	0	-100.0
Gallbladder	0.42	0.38	93	123	117	0.42	0.27	156	158	103	-12.2
Small intestine	0.35	0.31	74	98	95	0.37	0.00	132	137	0	-100.0
Mouth	0.31	0.27	66	87	84	0.33	1.14	116	124	428	409.3
Myeloid leukemia	0.29	0.26	61	81	80	0.32	0.16	111	119	61	-24.3
Other thoracic organs	0.25	0.24	56	74	72	0.26	1.90	94	98	713	890.8
Tongue	0.23	0.21	50	67	63	0.23	0.00	86	86	0	-100.0
Salivary glands	0.18	0.17	41	55	53	0.19	0.00	69	73	0	-100.0
Pharynx unspecified	0.18	0.17	40	53	51	0.17	0.00	68	65	0	-100.0
Anus	0.17	0.16	38	50	49	0.2	0.00	64	75	0	-100.0
Nose, sinuses	0.16	0.16	37	49	47	0.17	0.09	62	66	36	-24.3
Hypopharynx	0.13	0.11	27	36	35	0.15	0.35	48	56	131	275.6
Kaposi sarcoma	0.11	0.10	24	32	31	0.11	0.28	41	43	105	240.3
All sites except other skin	69.49	62.22	14883	19680	18974	68.88	73.92	26127	25899	27790	46.5
All sites	76.93	68.88	16476	21786	21005	76.69	83.9	28925	28832	31546	50.2

* Adjusted for change in Iran age structure in 2010 and change in adjusted relative age-standardized rate during this period. Estimations for sites with number of new cases lower than 20 are not presented.

Table 24. Estimated number of new cancer cases and incidence rate for Iran in year 1996 and 2010 by cancer site, female

Site	1996–2000					2010					Increase (%)
	Incidence Rate		Total no. of new cases (5 Provinces, 5 years)	No. of new cases (Iran)		Incidence Rate		No. of new cases			
	Crude 5 Provinces	Age-adjusted for Iran age structure		Not Adjusted for Iran age structure	Age-adjusted for Iran age structure	Age-adjusted for Iran age structure 2010	Final*	Without any adjustment for age structure	Age-adjusted for Iran age structure 2010	Final*	
Breast	13.3	9.95	2151	2764	2661	11.98	18.24	3651	4395	6692	151.5
Stomach	9.33	6.32	1362	1750	1650	7.22	9.36	2319	2649	3433	108.1
Esophagus	8.89	5.89	1267	1628	1531	6.81	0.25	2161	2498	93	-93.9
Other skin	7.87	5.37	1160	1490	1419	6.39	8.47	1970	2343	3109	119.1
Colon	4.03	2.86	612	787	749	3.32	7.85	1047	1220	2880	284.5
Other and unspecified	3.24	2.67	540	694	669	2.77	1.92	980	1017	704	5.3
Leukemia unspecified	1.75	1.65	355	456	453	1.55	1.59	605	570	582	28.5
Thyroid	1.93	1.79	343	441	427	1.84	0.00	657	674	0	-100.0
Ovary	1.99	1.6	341	438	423	1.82	3.24	586	668	1189	181.0
Cervix uteri	2.25	1.54	341	438	419	1.93	3.49	565	710	1281	205.6
Brain, nervous system	1.73	1.43	319	409	399	1.57	0.00	525	575	0	-100.0
Rectum	1.98	1.39	295	378	359	1.64	1.79	510	601	658	83.4
Non-Hodgkin lymphoma	1.65	1.37	293	376	364	1.46	2.14	503	536	785	115.6
Lung	1.63	1.12	241	309	292	1.26	1.26	412	461	462	58.3
Bladder	1.55	1.1	226	291	274	1.2	1.87	402	439	685	150.0
Gallbladder	1.15	0.78	168	216	203	0.87	0.00	285	321	0	-100.0
Uterus unspecified	1.05	0.79	164	211	201	0.91	2.54	288	332	932	363.9
Corpus uteri	1.04	0.7	150	193	182	0.83	0.43	258	304	156	-14.1
Hodgkin disease	0.65	0.66	148	190	188	0.7	1.49	243	258	547	190.8
Liver	0.89	0.64	137	176	167	0.69	1.63	234	254	600	259.1
Bone	0.63	0.6	135	174	171	0.61	0.01	221	224	3	-98.1
Pancreas	0.88	0.64	129	166	157	0.68	1.48	235	249	542	245.5
Kidney	0.71	0.55	115	148	144	0.58	1.31	201	214	480	233.5
Connective & soft tissue	0.54	0.49	95	121	118	0.49	0.24	179	180	89	-24.7
Multiple myeloma	0.56	0.39	83	106	99	0.41	1.74	144	152	637	543.2
Tongue	0.49	0.34	71	92	86	0.37	0.25	126	137	91	5.4
Melanoma of skin	0.46	0.34	71	92	87	0.38	0.88	126	141	324	272.1
Larynx	0.46	0.31	69	88	83	0.36	0.32	114	134	116	39.9
Mouth	0.46	0.3	68	88	84	0.36	0.30	111	133	111	32.7
Lymphoid leukemia	0.39	0.29	61	79	75	0.31	0.66	106	113	242	222.9
Lip	0.37	0.25	54	70	66	0.28	0.00	90	104	0	-100.0
Myeloid leukemia	0.29	0.24	53	68	66	0.27	0.00	90	100	0	-100.0
Nasopharynx	0.28	0.23	47	61	59	0.25	1.30	85	93	475	705.2
Vagina	0.27	0.19	41	53	50	0.21	0.33	70	77	119	138.5
Small intestine	0.27	0.18	40	52	49	0.22	0.34	68	82	124	153.6
Eye	0.22	0.16	36	46	45	0.19	0.42	60	68	154	242.7
Salivary glands	0.2	0.18	34	44	43	0.19	0.58	66	71	214	397.0
Hypopharynx	0.22	0.14	31	40	38	0.17	0.37	50	62	136	256.7
Other thoracic organs	0.19	0.14	30	39	37	0.16	0.18	52	61	65	75.7
Pharynx unspecified	0.2	0.13	28	36	34	0.15	0.00	47	56	0	-100.0
Other female genitalia	0.13	0.1	21	27	26	0.12	0.00	36	42	0	-100.0
Nose, sinuses	0.12	0.09	18	24	22	0.1	0.24	33	36	88	301.2
Vulva	0.12	0.08	17	22	21	0.09	0.39	29	33	141	572.7
Anus	0.13	0.08	17	22	21	0.1	0.07	29	36	25	17.6
All sites excluding skin	68.88	50.85	10864	13958	13347	57.68	66.51	18655	21160	26048	95.2
All sites	76.76	56.22	12023	15448	14766	64.07	74.97	20625	23504	29156	97.5

* Adjusted for change in Iran age structure in 2010 and change in adjusted relative age-standardized rate during this period. Estimations for sites with number of new cases lower than 20 are not presented.

Table 25. Predicted number of new cancer cases in year 2010 for both sexes by site

Cancer site	Number of new cases in year						Increase (%)
	1996–2000			2010			
	Five provinces 5 years	Iran estimate not adjusted for age structure	Age-adjusted to Iran structure in 1996	Without any adjustment	Age-adjusted to Iran structure in 2010	Final*	
Stomach	4794	6287	5982	8259	8458	7189	20.2
Esophagus	3102	4054	3854	5304	5670	1570	-59.3
Other skin	2752	3596	3451	4769	5277	7309	111.8
Breast	2311	2976	2866	3926	4714	6830	138.3
Bladder	1363	1794	1716	2388	2421	3983	132.1
Other and unspecified	1309	1711	1658	2327	2371	2469	48.9
Colon	1234	1609	1544	2139	2368	5009	224.4
Lung	1225	1610	1533	2112	2117	3874	152.7
Non-Hodgkin lymphoma	898	1176	1145	1539	1612	2369	106.9
Leukemia unspecified	864	1129	1125	1491	1347	1880	67.1
Prostate	855	1130	1089	1805	1431	309	-71.6
Brain	718	938	917	1209	1292	375	-59.1
Rectum	654	853	819	1153	1278	2146	162.1
Larynx	504	664	636	890	903	349	-45.1
Thyroid	459	594	577	876	903	47	-91.8
Hodgkin disease	394	515	511	668	704	815	59.5
Liver	347	454	433	607	624	747	72.4
Bone	332	434	428	559	568	364	-14.9
Ovary	341	438	423	586	668	1189	181.0
Cervix uteri	341	438	419	565	710	1281	205.6
Pancreas	332	434	413	619	591	1172	183.7
Kidney	316	414	401	550	551	1297	223.5
Multiple myeloma	258	338	322	450	462	1423	341.9
Gallbladder	261	338	320	441	479	103	-67.9
Connective & soft tissue	209	273	265	394	389	89	-66.5
Testis	194	256	256	335	401	759	196.6
Lymphoid leukemia	181	236	228	309	315	242	6.2
Lip	175	230	220	297	321	322	46.5
Melanoma of skin	166	217	209	289	308	324	54.9
Uterus unspecified	164	211	201	288	332	932	363.9
Nasopharynx	151	198	193	265	290	732	279.5
Corpus uteri	150	193	182	258	304	156	-14.1
Mouth	134	175	167	227	257	539	222.9
Tongue	122	158	149	212	224	91	-39.1
Myeloid leukemia	114	149	147	200	219	61	-58.8
Small intestine	115	150	144	200	219	124	-13.7
Other thoracic organs	86	113	109	146	158	778	614.1
Salivary glands	76	99	95	135	144	214	125.0
Pharynx unspecified	69	90	85	115	121	0	-100.0
Hypopharynx	58	76	73	98	119	267	265.8
Nose, sinuses	55	72	70	95	102	124	76.9
Anus	56	73	70	93	111	25	-64.7
Eye	54	70	69	92	98	186	169.8
Vagina	41	53	50	70	77	119	138.5
Kaposi sarcoma	31	41	39	52	57	220	463.4
Other endocrine	28	37	36	53	54	0	-100.0
Tonsil	23	30	29	38	41	13	-55.7
Other female genitalia	21	27	26	36	42	0	-100.0
All sites except other skin	25747	33638	32320	44782	47059	53393	65.2
All sites	28499	37234	35771	49550	52336	60703	69.7

* Adjusted for change in Iran age structure in 2010 and change in adjusted relative age-standardized rate during this period.
Estimations for sites with number of new cases lower than 20 are not presented.

6. Discussion

The decreasing burden of infectious diseases and increasing non-communicable diseases during the last century are not limited to developed countries, developing countries have experienced such changes too (Lopez and Murray, 1998). It is predicted that, by 2020, non-communicable diseases will cause seven out of every ten deaths in developing countries. Among non-communicable diseases, special attention is devoted to cardiovascular diseases, diabetes, cancer and chronic pulmonary disease (Boutayeb 2006). A recent report from the Iran Ministry of Health demonstrated that more than 70% of deaths were caused by cardiovascular diseases, accidents and cancers whereas less than 3% of deaths were due to infectious diseases. Therefore, understanding and quantifying the burden of cancer as the second cause of non-injury death in the country is clearly justified. On the other hand, when there is no surveillance for cancer in developing countries such as Iran, research in the cancer epidemiology field is difficult. One of the crucial tools in cancer control is the cancer registry which can provide not only information for epidemiological research on cancer determinants, but also for planning and evaluating cancer control programs (Jensen et al. 1991). In the absence of a continuous systematic population-based cancer registry, this type of retrospective survey seemed feasible to determine the cancer incidence.

6.1 Strengths of this study

The trained survey team had access to all patient records, with close monitoring of expert pathologists and epidemiologists at the registry branch of DDRC in Tehran. The survey team obtained copies of pathology reports, imaging reports and endoscopy documents for the majority of cases. These data provide the most complete and accurate estimates of cancer occurrence that have been reported so far from Iran. Including new diagnosed cancer cases of five large provinces of Iran (including 15.7% of Iran; almost 9.5 million) for five years in this study allowed precise estimates of incidence for all cancers (even rare cancers).

This is the first time that cumulative incidence rates for men and women separately have been calculated for 0–64 and 0–69 years of life in Iran, which is a very tangible measure to

explain the burden of cancer in the region. Moreover, two novel methods have been presented in this study, one for correcting under-registration of elderly ages by modeling while the other uses adjusted relative age-standardized rate for estimating time trend of cancer incidence in incomplete developing cancer registries. This is a new method using time trend analysis of adjusted relative age-standardized rates instead of trend in ASR, which accounts for variation in completeness of registration over time and can be used as an indicator of validity for cancer registries.

The first prediction of the number of new cancer cases in Iran for 2010 is another aspect of this study. Altogether, using retrospective registration of cancer cases in these five provinces resulted in an overview of cancer burden in Iran. Some other provinces such as Semnan province have also tried to use this method to ascertain the cancer profile in their regions (Babaei et al. 2005).

6.2 Shortcomings of this study

One of the shortcomings of this study was its retrospective nature in the setting of suboptimal quality medical records kept in private and to some extent in public hospitals and other medical centers. Also, not using the ICD coding system in some of the medical facilities at the time of diagnosis made it impossible to classify all cancer cases from the topographic point of view. Not using a national unique code for each person at the time of diagnosis made duplicate elimination difficult. Metastatic cancer cases were not included in the registration, i.e. tumors with unknown origin have been excluded. Therefore, there is a slight under-estimation for those cases. However it was impossible to classify them into certain tumor sites.

This study was designed for regional purposes (provinces) and also provided estimates for the whole country of Iran. Therefore, these five provinces may not be representative of all of Iran, which questions the external validity of results.

The results of a study of cancer patterns among inpatients of public hospitals in Iran in 2000–2 showed that only 22.3% of all inpatient cancer cases are from rural areas, while the proportion of rural population was 35.5% in the latest census (Mehrabi et al. 2004). It is

also less probable that rural patients go to the private hospital because the private sector is very expensive. This may show that rural residents are less diagnosed or referred to the urban hospitals and our main source of data of this study has been from urban facilities. This may have resulted in an underestimation of about 10% for all cancers, especially for breast cancer, since the contribution of rural breast cancer cases in inpatient public hospitals was only 10.6% of all breast cancer cases (25% less than their proportion in the whole population). In general, the results of this study should be taken as the minimum incidence rates of cancers in Iran. Despite all these shortcomings, data from the first years of two continuous active population-based cancer registries in Ardebil and Golestan in 2004–5 show similar rates to those in the current study (Babai and Malih, unpublished data).

6.3 Corrected incidence rates

The decline at older ages in the age-specific incidence curves could be due to under-registration (Figure 7 and Figure 10). In this study, an attempt was made to correct this problem. Correction was carried out based on the Finnish female age-specific rate pattern for age older than 79 years using the Finnish pattern for all sites. This was chosen because Finnish cancer cases are believed to be correctly registered with a very high level of completeness in their population-based cancer registry (Teppo et al. 1994). As Finnish population is much older than that in Iran, using the pattern of their age-specific rates, especially female pattern with higher life expectancy, would be the best choice as a model for correction of under-registration of old cancer cases in Iran. Since the proportion of Iranian population over 79 in 1996 is very low (male 0.45%, female 0.54%), the correction does not substantially affect the rates and number of cases in that year. However, with increase of life expectancy, this proportion increases (predicted for 2010; 0.71% of all ages for men or 0.73% for women). This may affect the results because if the calculation of future rates is done without correction, results will be underestimated (Table 25).

Comparing the corrected figures of age-specific curves with the original ones showed how well this correction took care of the problem of under-registration in elderly ages. Other ways to solve this problem include using a truncated incidence rate which omits cases below 35 years in addition to ages over 74). Another way is to ignore this fact and only report the elderly ages as sums of all age groups over a certain age such as 65+ or 75+. This

will hide the defect in the age-specific curve. In this dissertation, it was preferred to try to improve the data rather than hiding or ignoring the problem. Therefore, this correction was used. The correction does not mean adjustment based on Finnish age structure, age-standardization or using Finnish incidence rates; it is only compensation for the under-registration of elderly cancer cases in incomplete registries. This correction is based on using data from cancer cases aged 70–79 in the incomplete registry multiplied by a coefficient from a complete registry to estimate incidence in those aged 80 or more (Equation 1). Corrected figures of age-specific curves seem more interpretable and realistic because they do not show any false decline in the incidence of common cancers in elderly ages while cancer is known to be a highly age-dependant disease increasing in elderly ages (except for some childhood cancers).

Opportunistic breast cancer screening is common among urban Iranian women and may be one of the causes of a rise at age 35 to 44 and a rather flat situation from 45 to 54, with a decrease in the incidence of breast cancer afterwards from 55 to 69 (possibly due to the diagnosis of this cancer earlier than what it used to be without screening; Figure 10). However, the curve returns to logarithmic increase after age 69, but again it is hampered by under-registration of elderly cases (80 and above). This phenomenon was seen in all the provinces, so it is not a random error. Similar phenomenon was seen in Osaka Prefecture in Japan and with further longitudinal analysis the reason for decline in the elderly ages appeared to be the birth cohort effect (Rothman 1998). So the birth cohort effect can partly justify the shape of age-specific curve for breast cancer. Longer period of study is needed to find the birth cohort effect (at least 15 years).

Using ASR is a good tool for comparison, but it is an artificial rate. Cumulative rate was therefore used to show how great the risk of a particular cancer is for this population in 70 years of life. Cumulative rate approximates cumulative risk and the interpretation is more tangible. For instance, the risk of cancer of any kind in men during 0–69 years of life was approximately 7.9%. Of this, around 45% was due to gastrointestinal tract (mostly stomach, esophagus and to some extent colon). For women, risk of any cancer during 0–69 years of life was approximately 6.4%. Of this risk, around 38% was for gastrointestinal tract (mostly stomach, esophagus and colon), and about 20% was due to breast cancer.

The cancer site “Uterus” as the fourth leading cancer in women was misleading because it only showed the topography code for uterine unspecified (ICD-O code C55). It was not certain whether it was corpus uteri or cervix uteri (page 91 Figure 14). Based on

unpublished data from an ongoing cancer registry in Ardebil, the majority of uterine unspecified is attributable to cervix uteri rather than corpus uteri. However, in spite of this, cervical cancer is very rare in Ardebil.

6.4 Comparisons

6.4.1 Past and present

An effort was made to ascertain the esophageal cancer incidence in the Caspian Littoral part of Iran in 1960's (Kmet and Mahboubi 1972). That large-scale survey showed a very high incidence rate for esophageal cancer in Northeastern Iran. The interesting finding in that study is the 10-fold variation in esophageal cancer rates between eastern and western parts of the Caspian Littoral in areas less than 500 km apart. Unfortunately, there was no information on the overall ASR of each cancer site in this region to compare with present data. In this study, the overall ASR for this region was estimated by ASRs of esophageal cancer and all cancer sites in these northern cities of Iran which included cities of Ardebil, Gilan, Mazandaran and Golestan provinces.

The incidence of esophageal cancer has declined to approximately two thirds of its previous rate in both females and males. This may reflect partly a real decrease in the incidence of this cancer due to overall improvement in socioeconomic status after the revolution of 1979 (Pourshams et al. 2005). It may be due to a change in risk factors of esophageal cancer such as poor nutrition (Cook-Mozaffari et al. 1979) and bad oral hygiene (Sepehr et al. 2005). Another explanation for this decrease might be the change in the classification of the lowest part of esophagus to the cardia of stomach which is done nowadays. However, the decline in the incidence of esophageal cancer is in line with the decrease found over years of study using ARASR (Figure 33 and Figure 34) and in another study with Shiraz and Tehran data (Yazdizadeh et al. 2005).

On the other hand, the incidence of all cancer sites during this 25–31 year period of time has increased substantially (54% increase in males and 63% in female, Figure 36). This increase does not seem to be real. However, there seems to be an overall increase in all sites of cancer at a slower pace in the society with change in some risk factors such as higher obesity (60% overweight in Golestan and 25% obese, BMI>30) and a tendency

toward western diet (Pourshams et al. 2005). Refrigerator ownership in rural areas has increased from less than 5% in 1970 to more than 90% at present. The change in lifestyle toward westernized fashions with less physical activity may be the reason behind overall increase in all cancer sites. Therefore, with current lifestyle, it is reasonable to expect higher incidence rates in the future. With the increase in population over time and with longer life expectancy, the cancer burden will make a major contribution to disease prevalence, mortality and the health budget. With the increasing proportion of high risk age group female population, population growth, and increasing incidence and survival rate in breast cancer, this cancer will have the highest number of survivors in the near future.

6.4.2 Present and future (time trend)

Studying time trends in the incidence of cancers is helpful to understand the present situation and the results can also be projected to the future. For a five-year study, the time trend was difficult to interpret especially when data on year of diagnosis was available only for three fourths of subjects. For cases with unknown year of diagnosis, which year they were diagnosed with cancer was not noted, but they were selected from medical records with a diagnosis of cancer in 1996 to 2000. However, the analysis was done for those cases with a known year of diagnosis. Time trend analysis and projection based on just five-year data is not optimal because of random variation in a short period of time.

Figure 30 illustrated changes in the number of new cases over time by province. In general, these trends should be interpreted quite cautiously because first, the duration of the study was quite short for these kinds of interpretations. Second, year of diagnosis was not reported for all cancer cases. Third, the increase may be due to the improvement of case ascertainment over time or real increase in incidence of cancers which was unlikely to have such a high annual increase. As this increase was seen in almost all cancer sites and all provinces, the reason was more likely to be improvement of case finding rather than real change in incidence. Also, cases with missing information on year of diagnosis may be more likely from the first years of study which would overestimate the increase in incidence rates over time.

In general, the results of the time trend analysis were uncertain (with doubt about completeness in first years of registration) and not easy to interpret. To tackle this issue, the

time trend of relative age-standardized ratio (RASR) was developed, tested and used. For this alternative method, leukemia was chosen as a reference cancer with constant ASR during time. The ASR of this cancer was constant for 50 years of registration in the Finnish Cancer Registry, like other valid registries such as SEER in USA (0% change from 1975–2001). Then relative age-standardized ratio for each cancer (ASR of each cancer relative to ASR of leukemia) was calculated.

Using ASR for trend analysis on the data of this study resulted in an unrealistically strong increase over a short time period. Thus, ARASR may be preferable to ASR in situations where completeness of registration is not 100% and is variable over time because it takes the ascertainment bias into account. Of course, use of ARASR involves two assumptions. First, incidence of leukemia cancer is constant over time, and second, if under-registration or over-registration occurs, it happens in all cancers to the same extent. For instance, if there was 15% under-registration in a registry in 1996, each and every cancer would be 15% under-registered in that year. If the under-registration in 2000 was 10%, then the change in ASR from 1996 to 2000 would show a 5% increase. In this situation, ARASR is more reliable because it is not affected by under/over-registration. If there was no real change in ASR, the change in completeness of registration would distort the ASR trend but not affect the ARASR trend.

Using adjusted relative age-standardized rate (ARASR) in the time trend analysis resulted in a slope coefficient in the linear regression which approximated the slope of time trend in incidence. Using ASR in the calculation of RASR or ARASR also accounted for the change in the age structure of population over time since it was already age-standardized. Using other measures such as crude incidence rate or number of cancer patients (morbidity odds ratio) in settings with incomplete registration could result in incorrect estimates.

The time trend analysis of ARASR for cancers in both sexes together demonstrated that incidence of ‘all sites’ was showing a slight increase over this 5-year period, but this increase was not statistically significant. The direction and amount of change in ARASR of different cancers as an approximate for incidence of cancers were different. The highest incidence change among leading cancers in both sexes was in esophagus, which decreased 0.45 units of ASR per year. This was in line with findings from the comparison of past and present data and from another study which showed change in morbidity odds ratio for the frequency data of Shiraz and Tehran 1972–1995 (Yazdizadeh et al. 2005). In contrast, using ASR in the trend analysis showed that the incidence of esophageal cancer is

increasing in both sexes (annually 0.15 units increase in women and 0.42 units in men) which is not consistent with current knowledge and practice. Using ARASR revealed that the incidence of stomach cancer was decreasing as well but at a slower pace. Yet the Shiraz and Tehran study showed an increase in stomach cancer similar to the change in women of our study. On the other hand, the incidences of breast and colon cancers were increasing while prostate was significantly decreasing. The increase in colon cancer was in line with the study by Yazdizadeh et al. (2005). Bladder and lung cancer incidences were increasing to the same extent over this period. The incidence of cervical cancer was almost constant over time. In general, using ASR in the trend analysis of this data showed an increase in all leading cancer sites, which does not seem realistic while the results of ARASR were more interpretable.

ARASR has the same unit as ASR because it is a ratio with no unit (RASR) multiplied by a rate with a unit of number per person-time ($\sum$ASR) divided by another ratio with no unit ($\sum$RASR). Therefore, adjusted relative age-standardized rate is not a ratio after adjustment and it has the same unit as rates. ARASR has another advantage as it takes the change in population age structure over time into account because the ASRs used in the calculation of ARASR have been already directly standardized by a standard population such as the World Standard Population. Therefore, ARASRs from countries are comparable to each other.

Using ARASR instead of ASR in trend analysis is new and should be tested in other cancer registries although it seems to work wherever the assumptions behind it are met. A similar concept has been used in another study where morbidity odds ratios (MOR) were compared between past and present situation of a cancer in the absence of accurate incidence estimates (Yazdizadeh et al. 2005). Yazdizadeh et al. used the number of childhood cancers as the reference group for cases of each cancer. They referred to another similar concept, morbidity or mortality odds ratio, as an alternative to proportional mortality ratio to assess cancer risk in the absence of denominators (Miettinen and Wang 1981). The concept of MOR does not seem an appropriate method for time trend analysis because the age structure of a population changes over time and MOR does not take the age structure into account while ARASR does. ARASR can also be used to evaluate completeness of registration. When ARASRs and ASRs and their trends are similar, it indicates correct registration (no under/over-registration) and if they are very different it may show a problem in validity of registration (under-registration or over-registration).

Using time trend analysis of ARASR and considering population growth and change in age structure of population, it is predicted that the number of new cases in year 2010 will increase 50% in men and 100% in women. The total number of new cases in 2010 will be more than 53,000 (about 28,000 men and 25,000 women). This increase will be a major burden for the health care system. With increased survival rate, the number of prevalent cancer patients will be substantially higher in 2010, especially in women.

The dramatic increase in breast cancer (2.5 times) may be partly due to the increase in population, aging of population and partly due to the fact that younger girls at the peak of the baby boom after the Iran revolution reach the age of breast cancer. In other words, those 10–30 year old women who composed the majority of female population in 1996 will be 25–45 years old in 2010 and will be at risk of breast cancer although in younger ages most of the breast cancers may be caused by inherited susceptibility. Given a good survival rate for breast cancer, survivors of this cancer will compose a remarkable portion of female population after 2010, similar to what is now seen in developed countries.

6.4.3 GLOBOCAN and this study

International Agency for Research on Cancer (IARC) estimated the cancer profile of every country in the world to assess the global burden of cancer. They used real data for countries with cancer registries, but for countries without any registry, cancer burden was estimated based on frequency data and estimates from neighboring similar countries. The results of this have been organized in the GLOBOCAN database. At the time of creating GLOBOCAN2000, there was no population-based cancer registry in Iran and the only available data was frequency data from hospitals in different provinces. They included data from Register of the Iranian Cancer Organization (1998–1982, Tehran, Tabriz and Isfahan hospitals) and Fars Province Cancer Registry (1978–1981, Shiraz hospitals) (Parkin et al. 1986). The source data for GLOBOCAN2002 came partly from this study (Ardebil, Golestan, Kerman and Mazandaran) and another part from Tehran metropolitan area (1997) by Tehran Cancer Institute. They used the mean of estimates from these two sources. The estimates by GLOBOCAN2002 and the result of this study were highly concordant because they shared the majority of their data sources except for Gilan (only available in this study) and Tehran (only in GLOBOCAN2002; Figure 39).

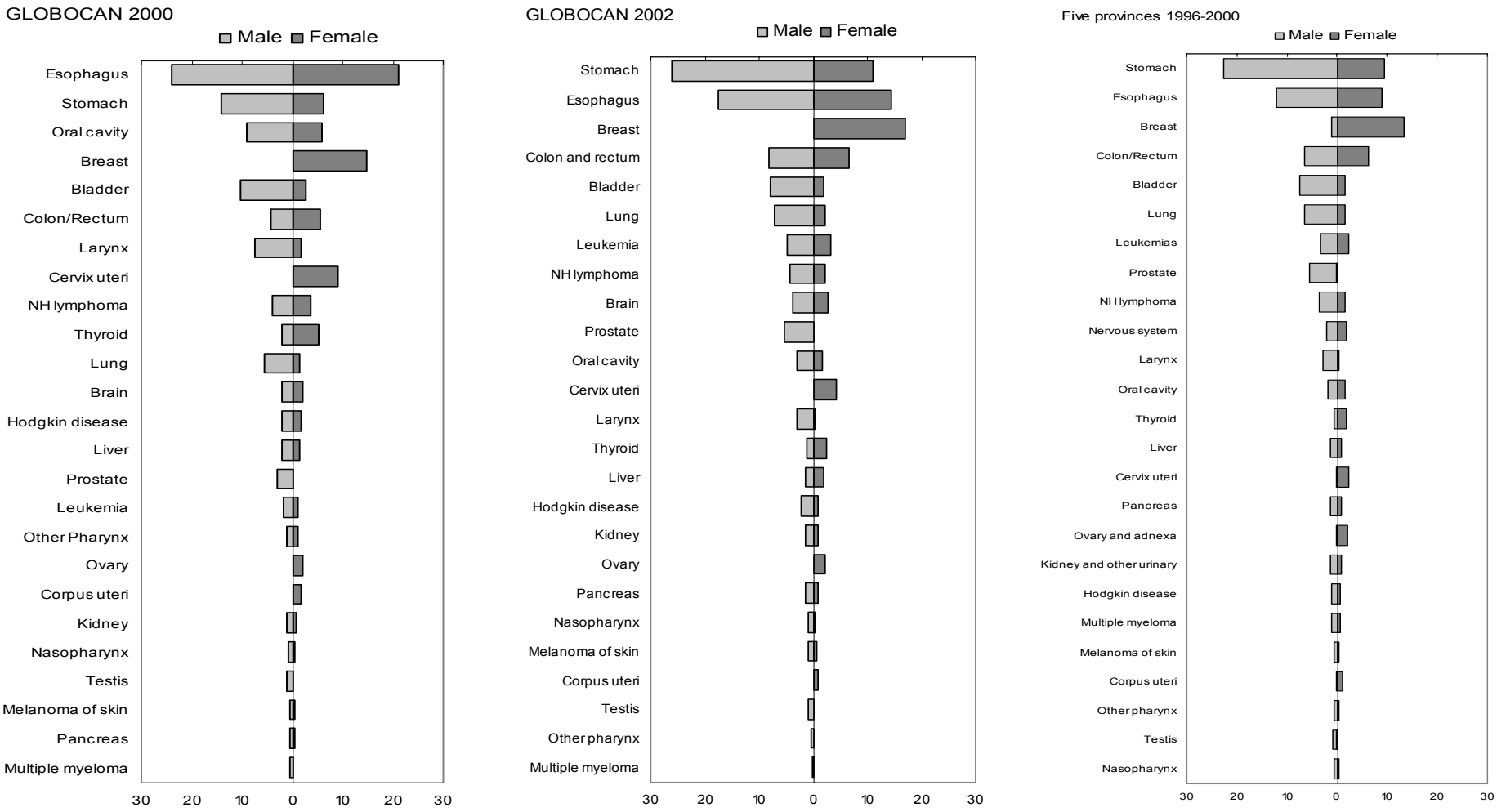

Figure 39. Iran, age-standardized rate (ASR per 10^5) by GLOBOCAN2000, GLOBOCAN2002 and 5 provinces 1996–2000

In general, the results of GLOBOCAN2002 and this study were very similar, and the only difference was higher incidence in almost all cancer sites in GLOBOCAN2002. This difference may be due to the fact that duplicate cases in shared parts of GLOBOCAN2002 and this study, were not eradicated completely at the time of creating GLOBOCAN2002 because there was a hurry to use all available data for the latest version of GLOBOCAN (2002). Nevertheless, the over-estimation in GLOBOCAN2002 was not substantial and only the incidence of cervical cancer was remarkably higher in GLOBOCAN2002, which may reflect higher cervical cancer incidence in Tehran. In addition, the results of the Tehran registry (with very large population at risk around 6,760,000) have been generally similar to those in this study.

6.4.4 Neighboring countries

Based on "Cancer Incidence in Five Continents Vol. VIII" there were only three countries around Iran with population-based cancer registries. They were all south of Iran: Pakistan in the southeast, Oman in the south and Kuwait in the southwest. Generally the incidence of cancer in Iran was lower than other neighbors in both men and women (Figure 40). The reason is unknown, but largely due to difference in the incidence of breast and lung cancers (higher in Pakistan) possibly a reflection of differences in risk factors, such as obesity and smoking, between these countries.

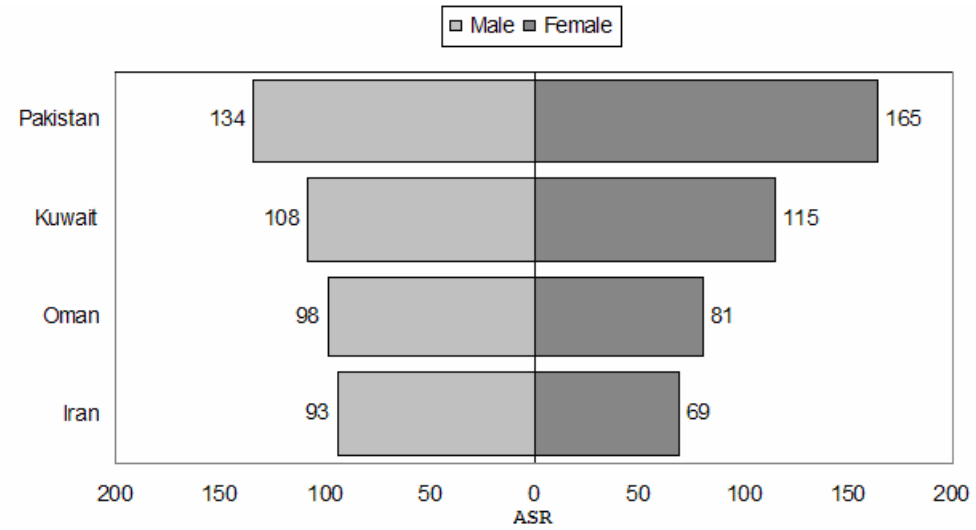

Figure 40. Age-standardized rate (/100,000 person-years) of Iran (1996–2000) and neighbors (Pakistan 1995–97, Kuwait 1994–97, Oman 1993–97)

The incidence of stomach and esophageal cancer in Iran in both women and men was moderately higher than Pakistan, Kuwait and Oman (Figure 41). On the other hand, the incidence of breast cancer was very high in Pakistan (ASR=53/100,000) and Kuwait, more than twice that in Iran or Oman. Bladder cancer was not very different in these 4 countries. Lung cancer was 2–3 times more common in Pakistan or Kuwait than in Oman or Iran. This may reflect the pattern of smoking in these countries. Pakistan and Iran (with similar incidence of prostate cancer) had lower incidence of prostate cancer than the two other countries.

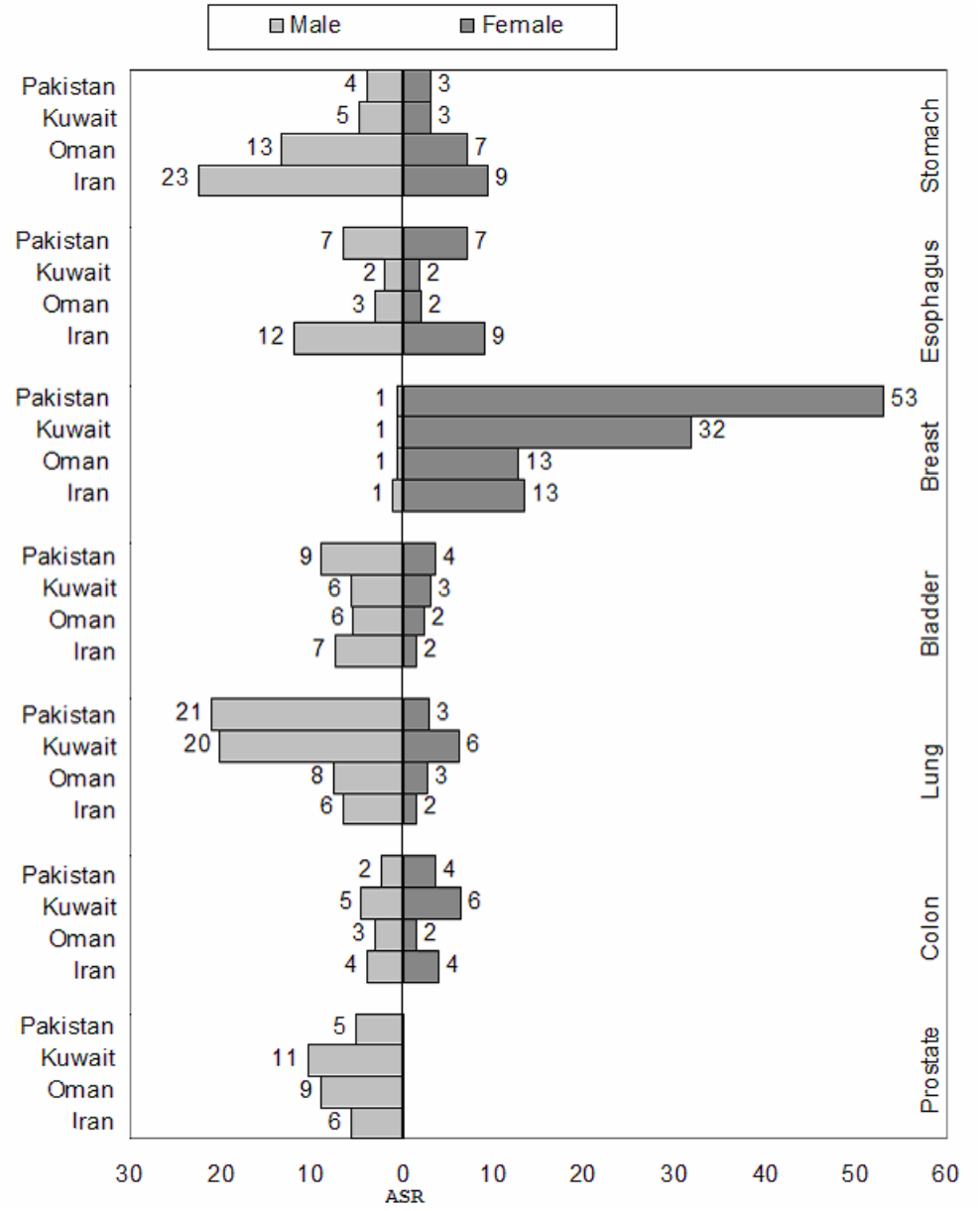

Figure 41. Age-standardized rate (/100,000 person-years) of leading cancers in countries around Iran that have cancer registries

6.4.5 Developing and developed countries

As demonstrated in Figure 42, in general, the incidence of all cancers in Iran was lower than the world average or even the average of less developed countries. The resulting overall estimated ASR of 93.4 in males and 68.9 in females was among the lowest in the world. ASR of cancers in Iran was less than half of the incidence of the world and less than

one third of more developed countries in both women and men. This is not due to the younger age structure in Iran because these numbers are already adjusted for age (standardized by world standard population). This low incidence in Iran does not apply to every cancer (Figure 43 and Appendix Figure 9).

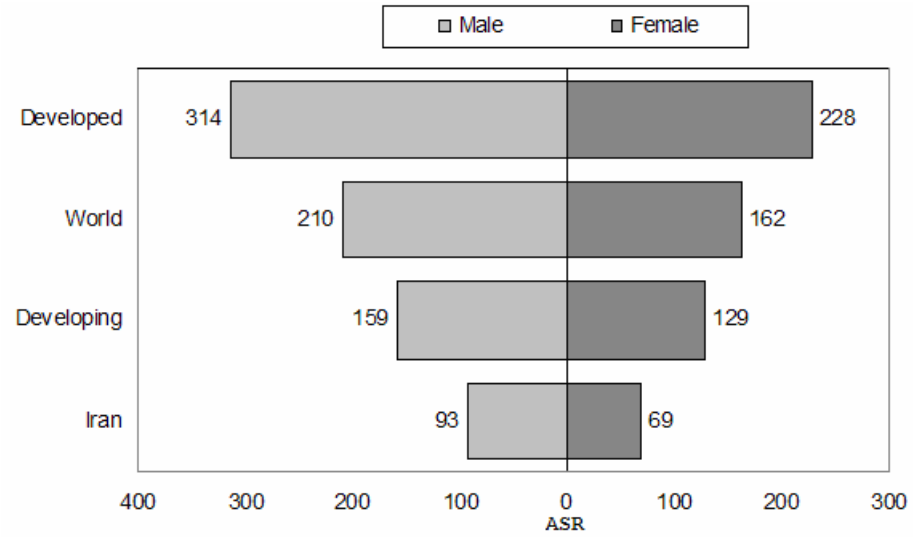

Figure 42. Age-standardized rate (/100,000 person-years) of all site cancers excluding non-melanoma skin in the world, developed countries, developing countries (2002) and Iran (1996–2000)

There were only a few cancers in Iran which have higher or similar ASR compared to the rest of the world. Hodgkin disease in men and women, and esophageal cancer in Iranian women were higher than the world average. Stomach cancer was very similar in all four categories. This comparison was made irrespective of regional variations within the country (for instance very high ASR of stomach cancer in Ardebil province (54/100,000 men) or very high ASR of esophageal cancer in Golestan province (24/100,000) well beyond the world average. The low incidence of lung cancer in Iran may reflect lower prevalence of smoking, especially in women (12.9% in males over 15 years old; Noorbala and Mohammad, 1999). Other explanations might be due to possible under-reporting, under-registration and difficulty in tissue diagnosis.

One interesting finding was the very low incidence of cervical cancer in Iran compared to any other parts of the world. This may be due to the fact that Iranians are very strict in their marital relationships, and, because of their religion, have almost no extra-marital partnerships. Information from neighboring Muslim countries supports this theory of lower incidence of cervical cancer associated with religion and sexual monogamy (Draini et al.

2002). The ASR of cervical cancer in Pakistan (6.8) Kuwait (5.6) and Oman (7.7) was also lower than the world average ($16.2/10^5$).

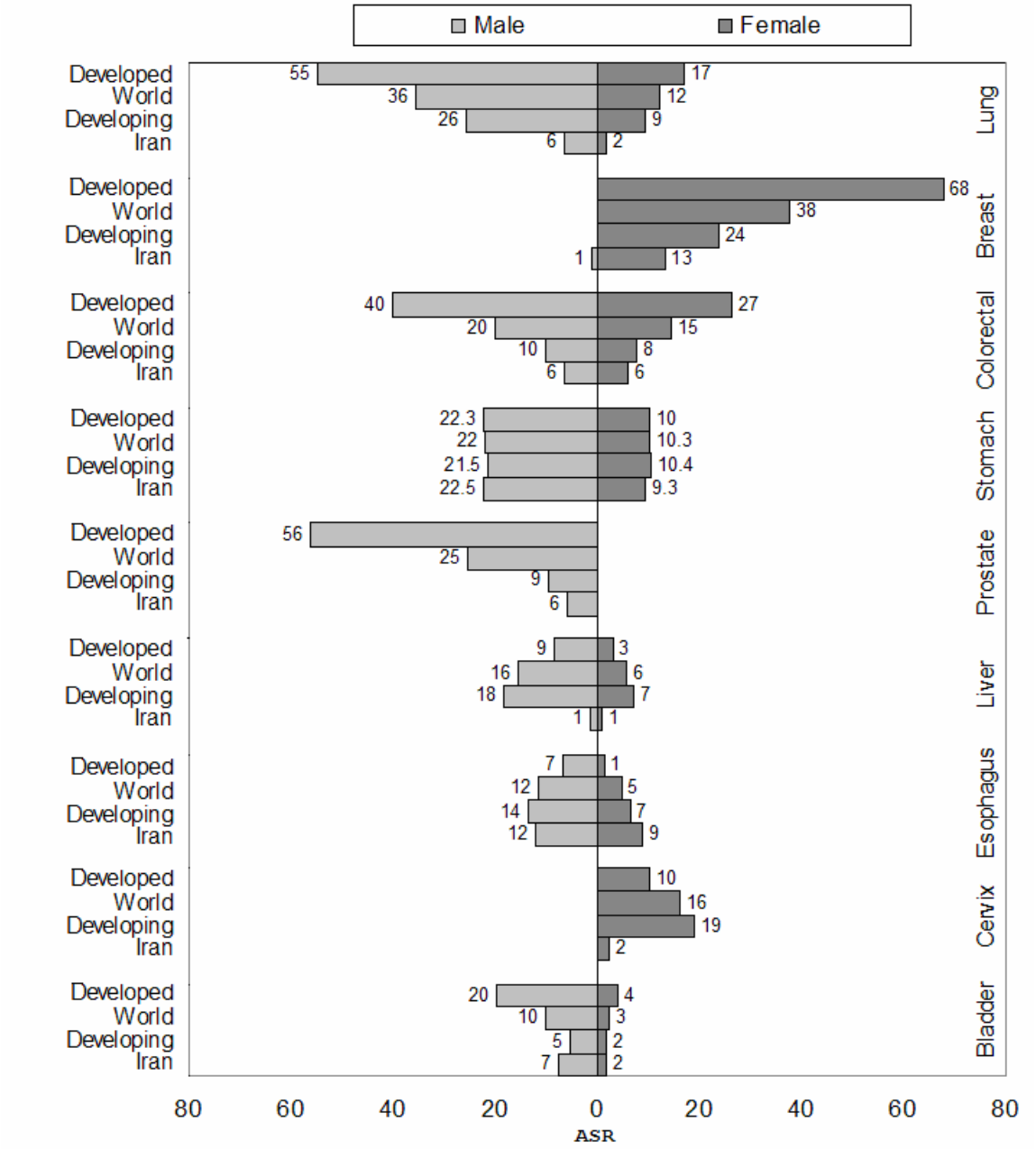

Figure 43. Age-standardized rate (/100,000 person-years) of leading cancers in the world, developed countries, developing countries (2002) and Iran (1996–2000)

6.5 Strategic targets for prevention and control

The most important human carcinogens include tobacco, asbestosis, aflatoxins and ultraviolet rays. Almost 20% of cancers are associated with chronic infections (hepatitis B and C viruses, HIV, HPV, Helicobacter pylori, schistosomiasis etc.). There is increasing recognition of the causative role of lifestyle factors including diet, physical activity and alcohol consumption. Genetic susceptibility may significantly alter the risk from environmental exposure (Stewart and Kleihues 2003, 21). These are the main strategic targets for the prevention and control of human cancer (Schottenfeld and Fraumeni 1996, 1404–1406). Since other common non-communicable diseases share the same lifestyle-related risk factors, action to prevent cancer should focus on controlling these risk factors in an integrated manner. This requires close coordination with programs for the prevention of other related non-communicable diseases mainly cardiovascular diseases, chronic obstructive pulmonary diseases and diabetes (Stewart and Kleihues 2003, 307).

The investigation of risk factors of cancer and preventive measures are beyond the scope of this study. However, since the estimation of the burden of cancer in terms of incidence, mortality, and prevalence is the first step to plan control measures and define priorities for preventive strategy, the results of this study can be used to prioritize the preventive measures based on the current status of cancer incidence in Iran.

Based on the results of this study stomach cancer is the most common cancer among Iranian men in terms of incidence higher than the world average. *Helicobacter pylori* is a causal agent for chronic atrophic gastritis, a precursor of gastric carcinoma. Prevalence of infection with *H. pylori* is positively correlated with stomach cancer mortality rate in countries throughout the world (Schottenfeld and Fraumeni 1996, 1406). Eradication of *H. pylori* interrupts the malignant pathway and reduces the cancer risk (Parsonnet et al. 1996). As the rate of *H. pylori* infection in Iran reaches 85% (Latifi-Navid et al. 2007), it seems necessary to allocate some research budget to study cost-effectiveness of screening program for *H. pylori* infection in high risk groups by a noninvasive test, such as serology or breath testing (i.e. in Ardebil).

Iran, like every other country, should give high priority to tobacco control in its fight against cancer. Given the multi-faceted impact of diet on cancer, the aim must also be to

encourage consumption of available vegetables, fruits and other agricultural products, and avoid the adoption of Western style eating habits. Dietary policy and measures to increase physical exercise and reduce obesity should be developed based on the local context. Thus there is a great need for effective and carefully evaluated school education programs in Iran for tobacco abstinence and healthy dietary habits.

The strategy for the early diagnosis of cancer should be a public and health professional activity. The public health education campaign should teach people to recognize early signs of cancers and urge them to seek prompt medical attention. Health professionals, especially primary health workers should be trained to identify cases that are suspicious and refer them for rapid diagnosis. Because of the considerable resources involved, population screening programs should be undertaken as a component of early detection where their effectiveness has been demonstrated (Stewart and Kleihues 2003, 307).

This study showed that breast cancer is the most common cancer in Iranian women in terms of incidence. On the other hand, the incidence of cervical cancer is substantially lower than in other parts of the world, especially in Ardebil, which has the lowest reported cervical cancer incidence in the world. Therefore, it seems more beneficial and rational to shift the national screening program in Iran from screening for cervical cancer to breast cancer if resources are limited. As mammography is a high cost procedure, in the first step it can be done only for high risk groups. Establishing a breast self-examination educational program and encouraging women to self-examine can be done for all women in order to detect cancer earlier and increase survival of patients (Hadi et al. 2002).

7. Summary

During the five years of study, 1996–2000, there were 28,022 new cancer cases in these five provinces of Iran: Ardebil, Gilan, Mazandaran, and Golestan in the north and Kerman in the south. In terms of age-standardized rate (ASR per 10^5), the most common cancers in males were stomach (22.5), esophagus (12.1), bladder (7.5), lung (6.5), colon/rectum (6.2) and prostate (5.6). The cumulative rate for 0–69 years of life in men was 7.8%. The most common female cancers were breast (13.3), stomach (9.3), esophagus (8.9), colon/rectum (6.0), leukemia (2.4) and cervical cancer (2.3). The cumulative rate for 0–69 years of life in women was 6.4%. In terms of incidence among these five provinces, stomach cancer had the highest rate in Ardebil province in both sexes. Highest rate of esophageal cancer was in Golestan in both sexes. Breast cancer was highest among Kermanian women. Highest rate of bladder and prostate cancer was recorded for Gilanian men whereas Gilanian women had highest rate of colorectal cancer. Highest rate of lung cancer found among Mazandaranian men. Kermanian men had the highest rate of skin or hematological neoplasms such as leukemia or lymphoma.

Generally the incidence of cancer in Iran was among lowest in the world. Cervical cancer was lower than even low risk countries such as China, Kuwait or Spain. Compared to 30 years ago, incidence of esophageal cancer declined to approximately two thirds of its previous level in both sexes. However, incidence of all other cancers including stomach cancer and breast cancer increased dramatically up to 120%. Although this increase was unrealistically high, most likely because of under-registration of other malignancies than esophagus 30 years ago, the real change seems to be in the same direction but with slower slope.

The estimates by GLOBOCAN2002 and the results of this study were highly concordant because they shared the majority of their data sources except for Gilan (only available in this study) and Tehran (only in GLOBOCAN2002).

It is predicted that the annual number of new cases excluding non-melanoma skin cancer in year 2010 in Iran compared to 1996 will increase 65% (women 95%; men 46%) to at least 53,000 persons. This increase in the number of new cases is a huge burden for the health

care system because by adding the number of old cases to these cases, the number of cancer patients will be substantially higher in 2010, especially in women.

A new method was developed and tested on some complete and incomplete cancer registry data to adjust for ascertainment bias in cancer registry data. In registries with incomplete reporting, ARASR was a better estimate for time trend analysis. ARASRs in different countries or different times were comparable since they were already standardized for age structure. In addition, comparison between time trend of ASR and ARASR could be used to evaluate completeness of registration.

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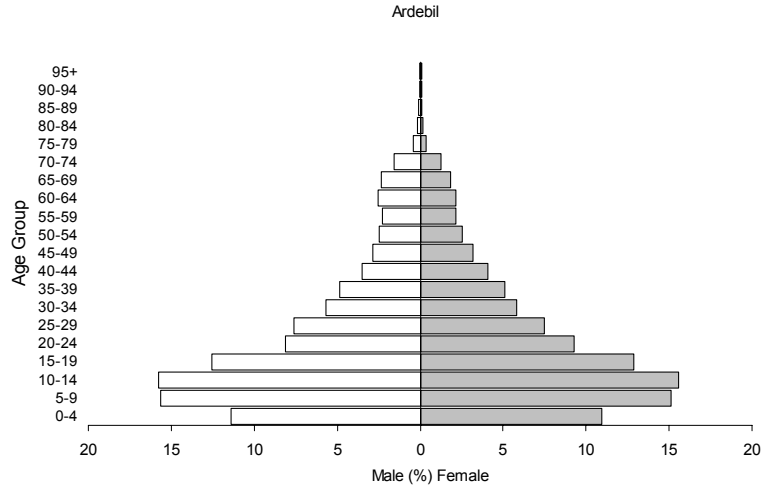
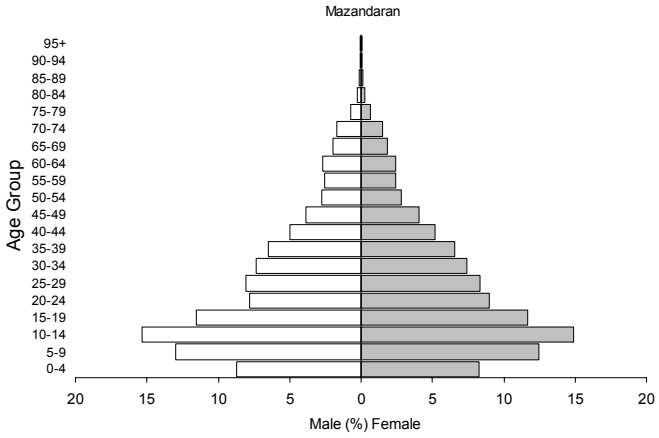
Appendices

Population pyramids of provinces

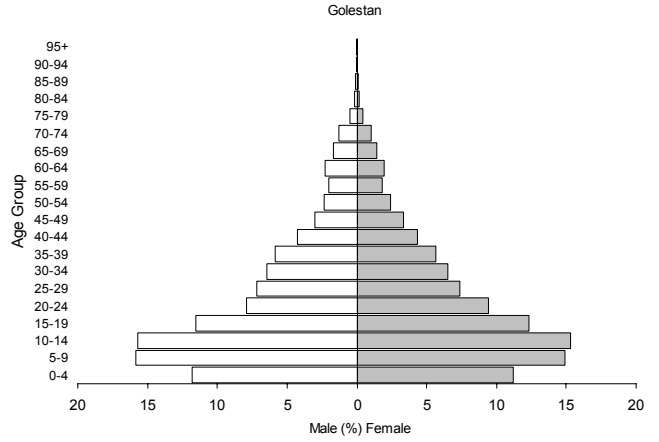


Appendix Figure 1. Population pyramid of Ardebil

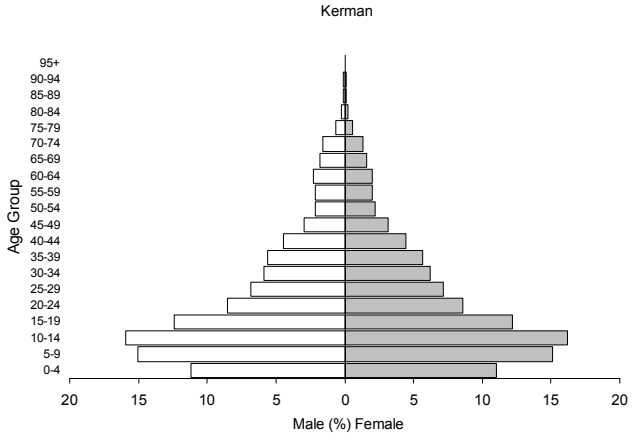
Appendix Figure 2. Population pyramid of Gilan province



Appendix Figure 3. Population pyramid of Mazandaran



Appendix Figure 4. Population pyramid of Golestan



Appendix Figure 5. Population pyramid of Kerman

Appendix Table 1. Number of cases and person-years by province and age group

	Province	Sex	Age group																		
			0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85+	Unknown	Total
No. of cases (all sites)	Ardebil	Male	8	28	23	21	38	39	47	51	66	97	136	193	343	358	357	167	38	33	61	2104
		Female	12	16	18	30	31	32	41	60	93	107	137	127	195	152	160	61	30	19	84	1405
	Gilan	Male	35	60	46	56	60	63	118	122	161	250	289	339	662	632	691	367	86	45	384	4466
		Female	29	26	37	41	61	89	148	186	250	259	252	266	365	314	311	169	50	28	235	3116
	Mazandaran	Male	62	83	88	98	83	95	132	112	203	234	284	306	506	604	756	422	148	79	459	4754
		Female	44	55	57	66	54	87	150	216	294	263	309	256	374	307	285	175	62	57	288	3399
	Golestan	Male	14	13	16	25	23	33	36	56	87	80	128	120	243	214	283	145	62	24	65	1667
		Female	11	13	23	23	32	46	77	108	136	125	113	108	149	126	132	59	16	15	79	1391
	Kerman	Male	62	84	88	63	73	56	93	107	150	147	185	207	354	326	382	233	95	34	202	2941
		Female	28	46	57	80	61	88	109	127	191	202	238	161	260	209	216	103	47	20	148	2391
Person-years	Ardebil	Male	268836	369108	371792	296008	192236	179488	134064	114960	82008	67232	57876	54476	59596	55168	37232	10572	4200	4740	192	2359784
		Female	252552	349324	359736	298148	213920	172232	134708	117452	94104	73152	58876	49368	49332	42304	29256	7780	3516	6400	100	2312260
	Gilan	Male	493590	678110	801580	643745	406385	446785	400870	357420	290785	223485	169050	163950	183165	144935	110280	37650	13615	11365	190	5576955
		Female	472970	652515	773095	672750	502610	465130	400895	361295	294455	225765	170900	158100	164400	135965	103240	42430	15895	20100	15	5632525
	Mazandaran	Male	565365	839785	995920	748055	503885	524395	477380	419245	323395	251135	179585	164815	173265	126625	109820	46730	17060	14435	3310	6484205
		Female	541175	812645	971125	760545	586045	544285	482795	427340	336865	263280	183285	158970	158780	117885	96330	43150	18570	19985	2780	6525835
	Golestan	Male	418015	562305	558460	410735	279660	254100	229860	206915	152155	107520	82590	71645	80635	60950	46210	17100	5840	6380	360	3551435
		Female	401700	534325	547430	441780	337730	264660	233935	202330	156045	120675	86715	65945	69275	51645	36800	15620	5495	7615	285	3580005
	Kerman	Male	569315	766040	811655	631430	433615	349040	300695	284890	228100	150120	108650	107640	117125	91895	80490	34025	12940	12615	725	5091005
		Female	543060	745415	797785	601965	424285	353470	307470	279345	218510	154525	108085	98840	100350	77030	66435	28560	12365	12770	370	4930635
	5 Provinces	Male	2315121	3215348	3539407	2729973	1815781	1753808	1542869	1383430	1076443	799492	597751	562526	613786	479573	384032	146077	53655	49535	4777	23063384
		Female	2211457	3094224	3449171	2775188	2064590	1799777	1559803	1387762	1099979	837397	607861	531223	542137	424829	332061	137540	55841	66870	3550	22981260
		Both	4526578	6309572	6988578	5505161	3880371	3553585	3102672	2771192	2176422	1636889	1205612	1093749	1155923	904402	716093	283617	109496	116405	8327	46044644

Appendix Table 2. Number of cases by site and age group, male

Site	Age group																			
	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85+	Unknown	Total
Lip	0	0	0	1	2	1	3	3	3	5	10	11	15	18	21	12	3	1	6	115
Tongue	0	0	0	0	1	0	1	2	2	5	3	4	11	6	9	2	1	1	2	50
Mouth	0	1	0	0	0	1	3	1	4	5	9	5	10	3	11	4	2	4	5	68
Salivary glands	1	0	0	1	3	1	1	5	3	4	1	4	8	6	2	0	1	0	1	42
Tonsil	0	1	0	0	0	0	0	0	1	2	0	1	2	1	4	1	0	0	0	13
Other oropharynx	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
Nasopharynx	3	0	2	4	6	3	4	4	9	11	9	5	11	10	8	5	1	0	6	101
Hypopharynx	0	0	0	0	0	1	0	3	3	5	6	0	0	2	3	1	1	0	2	27
Pharynx unspecified	0	0	0	0	0	0	0	0	5	0	2	3	6	13	5	3	1	1	1	40
Esophagus	3	1	2	3	1	17	25	31	54	68	134	121	295	257	381	189	54	26	89	1751
Stomach	7	6	7	8	13	29	40	57	77	128	198	282	578	581	640	310	100	36	200	3297
Small intestine	0	1	1	0	1	1	2	3	4	4	6	8	7	9	9	7	2	0	6	71
Colon	4	1	6	9	21	18	27	31	42	46	42	52	71	65	77	35	12	7	44	610
Rectum	0	0	0	0	5	12	10	18	26	24	30	26	40	38	43	31	8	3	32	346
Anus	0	0	0	0	1	2	4	3	1	3	4	6	4	3	4	1	2	0	1	39
Liver	1	1	0	0	2	5	3	5	12	10	14	14	28	29	37	17	2	2	17	199
Gallbladder	0	0	0	0	0	0	0	2	7	4	6	5	16	19	13	10	5	6	3	96
Pancreas	0	2	0	0	1	2	1	3	10	10	10	13	26	39	30	15	4	1	28	195
Nose, sinuses	1	1	2	0	1	0	3	3	1	2	2	5	3	3	5	2	1	0	1	36
Larynx	0	2	0	0	1	4	3	7	27	26	30	34	73	63	57	40	4	4	37	412
Lung	1	2	0	2	2	6	13	7	19	33	59	71	171	168	196	95	31	11	56	943
Other thoracic organs	1	2	0	0	2	0	3	4	4	1	1	8	10	7	4	4	2	0	2	55
Bone	3	2	19	44	16	13	7	5	6	6	8	13	13	12	9	6	1	0	10	193
Melanoma of skin	1	0	1	0	1	1	5	4	8	3	2	4	20	8	11	12	3	1	5	90
Other skin	6	8	10	10	13	21	33	41	107	126	131	123	158	208	218	148	69	39	115	1584
Mesothelioma	0	0	0	1	0	0	1	1	0	0	0	0	0	0	2	1	0	0	0	6
Kaposi sarcoma	0	0	0	1	1	0	2	1	2	1	2	0	4	6	0	2	0	1	1	24
Connective & soft tissue	5	3	5	6	4	4	6	5	6	11	9	5	13	8	4	3	3	1	15	116
Breast	1	0	0	1	1	1	7	9	23	25	19	11	18	6	14	9	2	2	8	157
Penis	0	0	0	0	0	0	0	0	1	0	1	1	4	2	1	0	0	3	0	13
Prostate	5	5	1	1	6	4	1	4	3	5	16	24	75	107	195	114	37	17	195	815
Testis	5	1	2	13	18	27	37	29	15	12	7	3	5	1	4	2	2	0	11	194
Other male genitalia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Kidney	12	13	2	3	3	0	5	3	5	10	14	17	35	25	22	11	2	2	12	196
Renal pelvis	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	2
Ureter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Bladder	2	1	8	2	9	7	16	23	26	66	61	85	154	176	203	122	27	18	76	1082
Other urinary organs	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	3
Eye	2	2	1	0	1	0	2	0	0	0	1	0	1	0	5	1	2	2	1	21
Brain, nervous system	9	33	25	18	19	13	31	22	23	33	27	32	24	29	22	11	2	2	19	394
Thyroid	1	1	0	1	6	4	12	10	9	7	9	8	9	7	7	5	1	1	16	114
Adrenal gland	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Other endocrine	0	2	0	1	2	2	1	1	1	1	0	2	2	0	0	0	0	0	3	18
Hodgkin disease	6	18	23	22	26	16	16	20	14	12	12	14	11	8	5	5	1	0	14	243
Non-Hodgkin lymphoma	20	28	34	23	24	24	22	32	46	27	43	57	46	48	59	22	11	8	29	603
Immunoproliferative	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	2
Multiple myeloma	2	1	2	2	1	2	3	4	3	14	14	15	34	26	17	14	2	1	11	168
Lymphoid leukemia	0	9	8	4	2	1	1	1	3	9	9	9	15	15	11	10	4	2	5	118
Myeloid leukemia	1	3	0	5	5	3	9	3	6	3	3	3	5	3	0	2	0	1	6	61
Leukemia unspecified	54	90	72	54	31	21	24	12	14	13	8	15	19	13	20	9	4	2	32	507
Other and unspecified	27	26	26	24	27	19	39	29	34	30	50	51	69	91	86	48	19	8	53	756
All sites	184	267	262	264	279	286	426	452	669	810	1023	1170	2119	2140	2478	1341	429	216	1177	15992
All sites excluding skin	178	259	252	254	266	265	393	411	562	684	892	1047	1961	1932	2260	1193	360	177	1062	14408

Appendix Table 3. Number of cases by site and age group, female

Site	Age group																			
	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85+	Unknown	Total
Lip	1	0	0	2	0	1	1	2	2	2	2	5	12	7	7	4	2	1	2	53
Tongue	0	0	0	1	0	0	3	2	2	6	5	1	17	3	13	5	1	2	7	68
Mouth	0	1	2	1	0	2	3	1	2	1	9	2	9	12	7	8	1	0	1	62
Salivary glands	0	1	0	1	1	4	3	2	1	3	4	3	2	1	2	0	0	0	6	34
Tonsil	0	0	0	0	0	0	0	0	0	0	0	2	1	2	2	1	0	0	0	8
Other oropharynx	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nasopharynx	0	1	1	0	3	4	1	5	5	4	6	1	5	4	2	0	0	0	5	47
Hypopharynx	0	0	0	0	0	0	2	0	0	2	7	2	1	5	9	1	0	0	0	29
Pharynx unspecified	0	0	0	0	0	0	0	1	4	1	4	5	4	6	2	0	0	0	1	28
Esophagus	1	1	0	4	2	8	14	22	65	83	117	125	224	170	175	81	33	24	81	1230
Stomach	2	4	3	11	9	13	35	37	68	68	108	112	221	197	187	95	30	24	85	1309
Small intestine	0	0	0	0	0	3	2	2	3	4	5	3	6	5	3	1	0	1	2	40
Colon	3	0	2	8	14	16	16	45	42	53	54	63	68	71	55	29	7	7	41	594
Rectum	0	0	0	0	6	9	10	16	20	21	30	38	45	21	29	12	11	5	23	296
Anus	0	0	0	0	0	0	0	0	1	3	2	3	5	0	2	0	1	2	1	20
Liver	4	1	3	2	1	4	2	5	7	14	11	3	20	19	21	4	0	1	9	131
Gallbladder	1	0	1	1	0	3	2	2	8	7	10	8	32	18	34	14	4	1	10	156
Pancreas	0	1	1	0	0	3	0	5	4	5	11	8	7	20	24	11	4	6	16	126
Nose, sinuses	0	0	1	0	0	1	0	0	0	3	1	2	3	0	3	1	1	0	2	18
Larynx	2	0	0	0	2	0	2	5	3	4	7	8	8	8	11	2	1	0	3	66
Lung	0	0	3	2	4	2	2	8	11	15	14	20	25	36	43	18	4	1	16	224
Other thoracic organs	0	0	0	1	1	0	3	1	5	1	3	4	5	2	2	0	0	0	2	30
Bone	2	7	26	18	18	7	7	4	3	5	6	0	8	6	4	6	2	0	3	132
Melanoma of skin	0	1	1	1	1	0	5	3	6	4	2	9	6	4	9	6	4	2	7	71
Other skin	4	5	4	6	10	31	33	43	70	103	126	84	116	114	139	100	38	26	70	1122
Mesothelioma	1	0	1	0	0	0	1	1	0	0	1	0	2	0	0	0	0	0	0	7
Kaposi sarcoma	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	2	2	0	0	7
Connective & soft tissue	3	4	1	6	4	7	4	5	8	4	11	3	4	9	4	1	1	1	15	95
Breast	3	1	1	7	22	73	176	261	364	299	225	154	143	97	89	52	15	10	128	2120
Vulva	2	0	0	0	0	0	1	0	0	0	1	2	3	2	3	1	1	0	1	17
Vagina	2	0	1	2	1	0	2	1	0	4	3	3	5	8	2	2	0	0	3	39
Cervix uteri	1	0	0	0	2	3	23	38	35	37	52	41	32	26	11	14	3	2	13	333
Corpus uteri	0	0	0	0	0	3	5	6	9	9	20	20	26	25	6	5	2	1	11	148
Uterus unspecified	0	0	1	1	3	10	10	9	19	20	18	11	20	14	8	2	1	2	15	164
Ovary	1	2	8	20	16	21	24	32	30	28	24	26	33	18	17	8	0	2	24	334
Other female genitalia	0	0	0	0	3	2	2	0	1	0	1	3	2	4	2	0	0	0	1	21
Placenta	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2
Kidney	15	7	1	2	2	2	3	4	8	9	9	7	11	9	6	5	3	0	10	113
Renal pelvis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ureter	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Bladder	1	1	0	2	2	3	4	6	8	9	15	19	35	30	34	16	6	6	23	220
Other urinary organs	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	3
Eye	5	3	0	1	0	1	1	1	3	0	4	2	1	1	3	4	0	0	2	32
Brain, nervous system	10	27	22	19	17	16	20	24	19	20	21	25	32	13	14	4	0	1	10	314
Thyroid	0	0	7	7	14	25	35	33	42	27	17	14	14	20	19	5	1	0	57	337
Adrenal gland	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	4
Other endocrine	0	0	1	0	0	1	1	1	0	0	1	2	1	1	0	0	0	0	1	10
Hodgkin disease	1	4	13	41	17	12	14	9	6	3	6	6	8	3	1	0	0	1	4	149
Non-Hodgkin lymphoma	2	19	15	15	14	16	21	13	15	14	20	15	29	15	29	8	6	3	21	290
Immunoproliferative	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Multiple myeloma	0	0	2	1	1	0	0	3	4	1	7	5	21	13	12	2	3	0	7	82
Lymphoid leukemia	3	0	3	0	1	1	0	4	5	5	2	4	7	10	5	3	3	0	5	61
Myeloid leukemia	3	1	3	6	3	7	3	1	2	3	3	2	6	1	2	2	1	0	3	52
Leukaemia unspecified	43	44	45	30	20	9	9	12	20	16	16	11	11	12	15	9	5	0	23	350
Other and unspecified	9	19	19	22	24	19	22	22	35	39	29	35	46	48	38	24	8	7	65	530
All sites	125	156	192	241	239	343	527	698	966	960	1052	921	1346	1111	1106	568	205	139	835	11730
All sites excluding skin	121	151	188	235	229	312	494	655	896	857	926	837	1230	997	967	468	167	113	765	10608

Age-specific incidence rates after correction

Corrections mentioned in the appendix have been explained on pages 76.

Appendix Table 4. Age-specific incidence rates, male (corrected for cases of unknown ages and under-registration in elderly ages)

Sites	Age-specific incidence rates (per 100,000 person-years)																		Crude rate (/100,000)
	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85+	
Lip	0.00	0.00	0.00	0.04	0.11	0.06	0.19	0.22	0.28	0.63	1.67	1.96	2.44	3.75	5.47	8.21	8.83	10.50	0.52
Tongue	0.00	0.00	0.00	0.00	0.06	0.00	0.06	0.14	0.19	0.63	0.50	0.71	1.79	1.25	2.34	1.37	2.39	2.32	0.22
Mouth	0.00	0.03	0.00	0.00	0.00	0.06	0.19	0.07	0.37	0.63	1.51	0.89	1.63	0.63	2.86	2.74	3.61	3.92	0.29
Salivary glands	0.04	0.00	0.00	0.04	0.17	0.06	0.06	0.36	0.28	0.50	0.17	0.71	1.30	1.25	0.52	0.00	0.34	0.21	0.18
Tonsil	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.25	0.00	0.18	0.33	0.21	1.04	0.68	1.11	1.11	0.06
Other oropharynx	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.17	0.10	0.01
Nasopharynx	0.13	0.00	0.06	0.15	0.33	0.17	0.26	0.29	0.84	1.38	1.51	0.89	1.79	2.09	2.08	3.42	3.55	4.30	0.45
Hypopharynx	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.22	0.28	0.63	1.00	0.00	0.00	0.42	0.78	0.68	0.95	1.00	0.12
Pharynx unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.33	0.53	0.98	2.71	1.30	2.05	2.16	2.60	0.18
Esophagus	0.13	0.03	0.06	0.11	0.06	0.97	1.62	2.24	5.02	8.51	22.42	21.51	48.06	53.59	99.21	129.38	147.46	170.63	7.95
Stomach	0.30	0.19	0.20	0.29	0.72	1.65	2.59	4.12	7.15	16.01	33.12	50.13	94.17	121.15	166.65	212.22	244.40	281.42	14.88
Small intestine	0.00	0.03	0.03	0.00	0.06	0.06	0.13	0.22	0.37	0.50	1.00	1.42	1.14	1.88	2.34	4.79	4.60	5.79	0.32
Colon	0.17	0.03	0.17	0.33	1.16	1.03	1.75	2.24	3.90	5.75	7.03	9.24	11.57	13.55	20.05	23.96	28.39	32.26	2.70
Rectum	0.00	0.00	0.00	0.00	0.28	0.68	0.65	1.30	2.42	3.00	5.02	4.62	6.52	7.92	11.20	21.22	20.91	25.97	1.56
Anus	0.00	0.00	0.00	0.00	0.06	0.11	0.26	0.22	0.09	0.38	0.67	1.07	0.65	0.63	1.04	0.68	1.11	1.11	0.17
Liver	0.04	0.03	0.00	0.00	0.11	0.29	0.19	0.36	1.11	1.25	2.34	2.49	4.56	6.05	9.63	11.64	13.72	15.63	0.91
Gallbladder	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.65	0.50	1.00	0.89	2.61	3.96	3.39	6.85	6.60	8.29	0.40
Pancreas	0.00	0.06	0.00	0.00	0.06	0.11	0.06	0.22	0.93	1.25	1.67	2.31	4.24	8.13	7.81	10.27	11.66	13.52	0.88
Nose, sinuses	0.04	0.03	0.06	0.00	0.06	0.00	0.19	0.22	0.09	0.25	0.33	0.89	0.49	0.63	1.30	1.37	1.72	1.91	0.16
Larynx	0.00	0.06	0.00	0.00	0.06	0.23	0.19	0.51	2.51	3.25	5.02	6.04	11.89	13.14	14.84	27.38	27.24	33.66	1.89
Lung	0.04	0.06	0.00	0.07	0.11	0.34	0.84	0.51	1.77	4.13	9.87	12.62	27.86	35.03	51.04	65.03	74.88	86.23	4.27
Other thoracic organs	0.04	0.06	0.00	0.00	0.11	0.00	0.19	0.29	0.37	0.13	0.17	1.42	1.63	1.46	1.04	2.74	2.44	3.19	0.24
Bone	0.13	0.06	0.54	1.61	0.88	0.74	0.45	0.36	0.56	0.75	1.34	2.31	2.12	2.50	2.34	4.11	4.16	5.10	0.85
Melanoma of skin	0.04	0.00	0.03	0.00	0.06	0.06	0.32	0.29	0.74	0.38	0.33	0.71	3.26	1.67	2.86	8.21	7.15	9.47	0.41
Other skin	0.26	0.25	0.28	0.37	0.72	1.20	2.14	2.96	9.94	15.76	21.92	21.87	25.74	43.37	56.77	101.32	101.98	125.29	6.91
Mesothelioma	0.00	0.00	0.00	0.04	0.00	0.00	0.06	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.68	0.78	0.90	0.03
Kaposi sarcoma	0.00	0.00	0.00	0.04	0.06	0.00	0.13	0.07	0.19	0.13	0.33	0.00	0.65	1.25	0.00	1.37	0.88	1.39	0.10
Connective & soft tissue	0.22	0.09	0.14	0.22	0.22	0.23	0.39	0.36	0.56	1.38	1.51	0.89	2.12	1.67	1.04	2.05	2.00	2.50	0.50
Breast	0.04	0.00	0.00	0.04	0.06	0.06	0.45	0.65	2.14	3.13	3.18	1.96	2.93	1.25	3.65	6.16	6.33	7.70	0.69
Vulva	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vagina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cervix uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Corpus uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kidney	0.52	0.40	0.06	0.11	0.17	0.00	0.32	0.22	0.46	1.25	2.34	3.02	5.70	5.21	5.73	7.53	8.55	9.91	0.87
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Ureter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bladder	0.09	0.03	0.23	0.07	0.50	0.40	1.04	1.66	2.42	8.26	10.20	15.11	25.09	36.70	52.86	83.52	87.97	105.69	4.93
Other urinary organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.52	0.00	0.34	0.21	0.01
Eye	0.09	0.06	0.03	0.00	0.06	0.00	0.13	0.00	0.00	0.00	0.17	0.00	0.16	0.00	1.30	0.68	1.28	1.21	0.08
Brain, nervous system	0.39	1.03	0.71	0.66	1.05	0.74	2.01	1.59	2.14	4.13	4.52	5.69	3.91	6.05	5.73	7.53	8.55	9.91	1.73
Thyroid	0.04	0.03	0.00	0.04	0.33	0.23	0.78	0.72	0.84	0.88	1.51	1.42	1.47	1.46	1.82	3.42	3.38	4.20	0.50
Adrenal gland	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Other endocrine	0.00	0.06	0.00	0.04	0.11	0.11	0.06	0.07	0.09	0.13	0.00	0.36	0.33	0.00	0.00	0.00	0.00	0.00	0.08
Hodgkin disease	0.26	0.56	0.65	0.81	1.43	0.91	1.04	1.45	1.30	1.50	2.01	2.49	1.79	1.67	1.30	3.42	3.05	3.99	1.06
NH lymphoma	0.86	0.87	0.96	0.84	1.32	1.37	1.43	2.31	4.27	3.38	7.19	10.13	7.49	10.01	15.36	15.06	19.63	21.38	2.62
Immunoproliferative	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple myeloma	0.09	0.03	0.06	0.07	0.06	0.11	0.19	0.29	0.28	1.75	2.34	2.67	5.54	5.42	4.43	9.58	9.04	11.48	0.76
Lymphoid leukemia	0.00	0.28	0.23	0.15	0.11	0.06	0.06	0.07	0.28	1.13	1.51	1.60	2.44	3.13	2.86	6.85	6.26	8.08	0.52
Myeloid leukemia	0.04	0.09	0.00	0.18	0.28	0.17	0.58	0.22	0.56	0.38	0.50	0.53	0.81	0.63	0.00	1.37	0.88	1.39	0.27
Leukemia unspecified	2.33	2.80	2.03	1.98	1.71	1.20	1.56	0.87	1.30	1.63	1.34	2.67	3.10	2.71	5.21	6.16	7.33	8.32	2.21
Other and unspecified	1.17	0.81	0.73	0.88	1.49	1.08	2.53	2.10	3.16	3.75	8.36	9.07	11.24	18.98	22.39	32.86	35.64	42.22	3.33
All sites	7.95	8.30	7.40	9.67	15.37	16.31	27.61	32.67	62.15	101.31	171.14	207.99	345.23	446.23	645.26	918.01	1008.44	1187.31	71.44
All sites excluding skin	7.69	8.06	7.12	9.30	14.65	15.11	25.47	29.71	52.21	85.55	149.23	186.12	319.49	402.86	588.49	816.69	906.46	1062.02	64.53

Appendix Table 5. Age-specific incidence rates, female (corrected for cases of unknown ages and elderly ages)

Sites	Age-specific incidence rates (per 100,000 person-years)																		Crude rate (/100,000)
	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85+	
Lip	0.05	0.00	0.00	0.07	0.00	0.06	0.06	0.14	0.18	0.24	0.33	0.94	2.21	1.65	2.11	2.91	3.24	3.79	0.24
Tongue	0.00	0.00	0.00	0.04	0.00	0.00	0.19	0.14	0.18	0.72	0.82	0.19	3.14	0.71	3.91	3.64	4.87	5.24	0.31
Mouth	0.00	0.03	0.06	0.04	0.00	0.11	0.19	0.07	0.18	0.12	1.48	0.38	1.66	2.82	2.11	5.82	5.11	6.74	0.30
Salivary glands	0.00	0.03	0.00	0.04	0.05	0.22	0.19	0.14	0.09	0.36	0.66	0.56	0.37	0.24	0.60	0.00	0.39	0.24	0.15
Tonsil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.18	0.47	0.60	0.73	0.86	0.98	0.04
Other oropharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nasopharynx	0.00	0.03	0.03	0.00	0.15	0.22	0.06	0.36	0.45	0.48	0.99	0.19	0.92	0.94	0.60	0.00	0.39	0.24	0.21
Hypopharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.24	1.15	0.38	0.18	1.18	2.71	0.73	2.22	1.81	0.14
Pharynx unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.36	0.12	0.66	0.94	0.74	1.41	0.60	0.00	0.39	0.24	0.12
Esophagus	0.05	0.03	0.00	0.14	0.10	0.44	0.90	1.59	5.91	9.91	19.25	23.53	41.32	40.02	52.70	58.89	71.99	80.66	5.51
Stomach	0.09	0.13	0.09	0.40	0.44	0.72	2.24	2.67	6.18	8.12	17.77	21.08	40.76	46.37	56.31	69.07	80.88	92.42	5.93
Small intestine	0.00	0.00	0.00	0.00	0.00	0.17	0.13	0.14	0.27	0.48	0.82	0.56	1.11	1.18	0.90	0.73	1.05	1.10	0.18
Colon	0.14	0.00	0.06	0.29	0.68	0.89	1.03	3.24	3.82	6.33	8.88	11.86	12.54	16.71	16.56	21.08	24.29	27.96	2.66
Rectum	0.00	0.00	0.00	0.00	0.29	0.50	0.64	1.15	1.82	2.51	4.94	7.15	8.30	4.94	8.73	8.72	11.26	12.32	1.28
Anus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.36	0.33	0.56	0.92	0.00	0.60	0.00	0.39	0.24	0.08
Liver	0.18	0.03	0.09	0.07	0.05	0.22	0.13	0.36	0.64	1.67	1.81	0.56	3.69	4.47	6.32	2.91	5.96	5.46	0.60
Gallbladder	0.05	0.00	0.03	0.04	0.00	0.17	0.13	0.14	0.73	0.84	1.65	1.51	5.90	4.24	10.24	10.18	13.17	14.39	0.73
Pancreas	0.00	0.03	0.03	0.00	0.00	0.17	0.00	0.36	0.36	0.60	1.81	1.51	1.29	4.71	7.23	8.00	9.82	10.98	0.56
Nose, sinuses	0.00	0.00	0.03	0.00	0.00	0.06	0.00	0.00	0.00	0.36	0.16	0.38	0.55	0.00	0.90	0.73	1.05	1.10	0.08
Larynx	0.09	0.00	0.00	0.00	0.10	0.00	0.13	0.36	0.27	0.48	1.15	1.51	1.48	1.88	3.31	1.45	3.07	2.79	0.30
Lung	0.00	0.00	0.09	0.07	0.19	0.11	0.13	0.58	1.00	1.79	2.30	3.76	4.61	8.47	12.95	13.09	16.80	18.42	1.05
Other thoracic organs	0.00	0.00	0.00	0.04	0.05	0.00	0.19	0.07	0.45	0.12	0.49	0.75	0.92	0.47	0.60	0.00	0.39	0.24	0.13
Bone	0.09	0.23	0.75	0.65	0.87	0.39	0.45	0.29	0.27	0.60	0.99	0.00	1.48	1.41	1.20	4.36	3.59	4.90	0.59
Melanoma of skin	0.00	0.03	0.03	0.04	0.05	0.00	0.32	0.22	0.55	0.48	0.33	1.69	1.11	0.94	2.71	4.36	4.56	5.50	0.31
Other skin	0.18	0.16	0.12	0.22	0.48	1.72	2.12	3.10	6.36	12.30	20.73	15.81	21.40	26.83	41.86	72.71	73.90	90.36	5.05
Mesothelioma	0.05	0.00	0.03	0.00	0.00	0.00	0.06	0.07	0.00	0.00	0.16	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.03
Kaposi sarcoma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.16	0.00	0.00	0.00	0.30	1.45	1.13	1.59	0.03
Connective & soft tissue	0.14	0.13	0.03	0.22	0.19	0.39	0.26	0.36	0.73	0.48	1.81	0.56	0.74	2.12	1.20	0.73	1.25	1.22	0.41
Breast	0.14	0.03	0.03	0.25	1.07	4.06	11.28	18.81	33.09	35.71	37.02	28.99	26.38	22.83	26.80	37.81	41.68	48.99	9.36
Vulva	0.09	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.16	0.38	0.55	0.47	0.90	0.73	1.05	1.10	0.08
Vagina	0.09	0.00	0.03	0.07	0.05	0.00	0.13	0.07	0.00	0.48	0.49	0.56	0.92	1.88	0.60	1.45	1.33	1.71	0.18
Cervix uteri	0.05	0.00	0.00	0.00	0.10	0.17	1.47	2.74	3.18	4.42	8.55	7.72	5.90	6.12	3.31	10.18	8.70	11.64	1.48
Corpus uteri	0.00	0.00	0.00	0.00	0.00	0.17	0.32	0.43	0.82	1.07	3.29	3.76	4.80	5.88	1.81	3.64	3.51	4.40	0.65
Uterus unspecified	0.00	0.00	0.03	0.04	0.15	0.56	0.64	0.65	1.73	2.39	2.96	2.07	3.69	3.30	2.41	1.45	2.49	2.43	0.71
Ovary	0.05	0.06	0.23	0.72	0.77	1.17	1.54	2.31	2.73	3.34	3.95	4.89	6.09	4.24	5.12	5.82	7.05	7.93	1.48
Other female genitalia	0.00	0.00	0.00	0.00	0.15	0.11	0.13	0.00	0.09	0.00	0.16	0.56	0.37	0.94	0.60	0.00	0.39	0.24	0.09
Placenta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Kidney	0.68	0.23	0.03	0.07	0.10	0.11	0.19	0.29	0.73	1.07	1.48	1.32	2.03	2.12	1.81	3.64	3.51	4.40	0.50
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ureter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00
Bladder	0.05	0.03	0.00	0.07	0.10	0.17	0.26	0.43	0.73	1.07	2.47	3.58	6.46	7.06	10.24	11.63	14.11	15.87	0.99
Other urinary organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.01
Eye	0.23	0.10	0.00	0.04	0.00	0.06	0.06	0.07	0.27	0.00	0.66	0.38	0.18	0.24	0.90	2.91	2.46	3.31	0.15
Brain, nervous system	0.45	0.87	0.64	0.68	0.82	0.89	1.28	1.73	1.73	2.39	3.45	4.71	5.90	3.06	4.22	2.91	4.60	4.62	1.39
Thyroid	0.00	0.00	0.20	0.25	0.68	1.39	2.24	2.38	3.82	3.22	2.80	2.64	2.58	4.71	5.72	3.64	6.04	5.96	1.49
Adrenal gland	0.00	0.03	0.00	0.00	0.05	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.02
Other endocrine	0.00	0.00	0.03	0.00	0.00	0.06	0.06	0.07	0.00	0.00	0.16	0.38	0.18	0.24	0.00	0.00	0.00	0.00	0.04
Hodgkin disease	0.05	0.13	0.38	1.48	0.82	0.67	0.90	0.65	0.55	0.36	0.99	1.13	1.48	0.71	0.30	0.00	0.19	0.12	0.64
NH lymphoma	0.09	0.61	0.43	0.54	0.68	0.89	1.35	0.94	1.36	1.67	3.29	2.82	5.35	3.53	8.73	5.82	9.39	9.37	1.27
Immunoproliferative	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00
Multiple myeloma	0.00	0.00	0.06	0.04	0.05	0.00	0.00	0.22	0.36	0.12	1.15	0.94	3.87	3.06	3.61	1.45	3.27	2.91	0.36
Lymphoid leukemia	0.14	0.00	0.09	0.00	0.05	0.06	0.00	0.29	0.45	0.60	0.33	0.75	1.29	2.35	1.51	2.18	2.38	2.81	0.27
Myeloid leukemia	0.14	0.03	0.09	0.22	0.15	0.39	0.19	0.07	0.18	0.36	0.49	0.38	1.11	0.24	0.60	1.45	1.33	1.71	0.23
Leukemia unspecified	1.94	1.42	1.30	1.08	0.97	0.50	0.58	0.86	1.82	1.91	2.63	2.07	2.03	2.82	4.52	6.54	7.14	8.43	1.54
Other and unspecified	0.41	0.61	0.55	0.79	1.16	1.06	1.41	1.59	3.18	4.66	4.77	6.59	8.48	11.30	11.44	17.45	18.64	22.24	2.35
All sites	5.65	5.04	5.57	8.68	11.58	19.06	33.79	50.30	87.82	114.64	173.07	173.37	248.28	261.52	333.07	412.97	481.26	551.13	52.32
All sites excluding skin	5.47	4.88	5.45	8.47	11.09	17.34	31.67	47.20	81.46	102.34	152.34	157.56	226.88	234.68	291.21	340.26	407.35	460.77	47.27

Age-specific incidence rates before correction

Appendix Table 6. Age-specific incidence rates, male (before correction for elderly ages)

Sites	Age-specific incidence rates (per 100,000 person-years)																		
	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85+	Total
Lip	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.6	1.7	2.0	2.4	3.8	5.5	8.2	5.6	2.0	0.5
Tongue	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.2	0.6	0.5	0.7	1.8	1.3	2.3	1.4	1.9	2.0	0.2
Mouth	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.4	0.6	1.5	0.9	1.6	0.6	2.9	2.7	3.7	8.1	0.3
Salivary glands	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.4	0.3	0.5	0.2	0.7	1.3	1.3	0.5	0.0	1.9	0.0	0.2
Tonsil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.2	0.3	0.2	1.0	0.7	0.0	0.0	0.1
Other oropharynx	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
Nasopharynx	0.1	0.0	0.1	0.1	0.3	0.2	0.3	0.3	0.8	1.4	1.5	0.9	1.8	2.1	2.1	3.4	1.9	0.0	0.4
Hypopharynx	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.3	0.6	1.0	0.0	0.0	0.4	0.8	0.7	1.9	0.0	0.1
Pharynx unspecified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.3	0.5	1.0	2.7	1.3	2.1	1.9	2.0	0.2
Esophagus	0.1	0.0	0.1	0.1	0.1	1.0	1.6	2.2	5.0	8.5	22.4	21.5	48.1	53.6	99.2	129.4	100.6	52.5	7.6
Stomach	0.3	0.2	0.2	0.3	0.7	1.7	2.6	4.1	7.2	16.0	33.1	50.1	94.2	121.1	166.7	212.2	186.4	72.7	14.3
Small intestine	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.4	0.5	1.0	1.4	1.1	1.9	2.3	4.8	3.7	0.0	0.3
Colon	0.2	0.0	0.2	0.3	1.2	1.0	1.7	2.2	3.9	5.8	7.0	9.2	11.6	13.6	20.1	24.0	22.4	14.1	2.6
Rectum	0.0	0.0	0.0	0.0	0.3	0.7	0.6	1.3	2.4	3.0	5.0	4.6	6.5	7.9	11.2	21.2	14.9	6.1	1.5
Anus	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.2	0.1	0.4	0.7	1.1	0.7	0.6	1.0	0.7	3.7	0.0	0.2
Liver	0.0	0.0	0.0	0.0	0.1	0.3	0.2	0.4	1.1	1.3	2.3	2.5	4.6	6.0	9.6	11.6	3.7	4.0	0.9
Gallbladder	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.5	1.0	0.9	2.6	4.0	3.4	6.8	9.3	12.1	0.4
Pancreas	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.9	1.3	1.7	2.3	4.2	8.1	7.8	10.3	7.5	2.0	0.8
Nose, sinuses	0.0	0.0	0.1	0.0	0.1	0.0	0.2	0.2	0.1	0.3	0.3	0.9	0.5	0.6	1.3	1.4	1.9	0.0	0.2
Larynx	0.0	0.1	0.0	0.0	0.1	0.2	0.2	0.5	2.5	3.3	5.0	6.0	11.9	13.1	14.8	27.4	7.5	8.1	1.8
Lung, trachea & bronchus	0.0	0.1	0.0	0.1	0.1	0.3	0.8	0.5	1.8	4.1	9.9	12.6	27.9	35.0	51.0	65.0	57.8	22.2	4.1
Other thoracic organs	0.0	0.1	0.0	0.0	0.1	0.0	0.2	0.3	0.4	0.1	0.2	1.4	1.6	1.5	1.0	2.7	3.7	0.0	0.2
Bone	0.1	0.1	0.5	1.6	0.9	0.7	0.5	0.4	0.6	0.8	1.3	2.3	2.1	2.5	2.3	4.1	1.9	0.0	0.8
Melanoma of skin	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.3	0.7	0.4	0.3	0.7	3.3	1.7	2.9	8.2	5.6	2.0	0.4
Other skin	0.3	0.2	0.3	0.4	0.7	1.2	2.1	3.0	9.9	15.8	21.9	21.9	25.7	43.4	56.8	101.3	128.6	78.7	6.9
Mesothelioma	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.7	0.0	0.0	0.0
Kaposi sarcoma	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.3	0.0	0.7	1.3	0.0	1.4	0.0	2.0	0.1
Connective & soft tissue	0.2	0.1	0.1	0.2	0.2	0.2	0.4	0.4	0.6	1.4	1.5	0.9	2.1	1.7	1.0	2.1	5.6	2.0	0.5
Breast	0.0	0.0	0.0	0.0	0.1	0.1	0.5	0.7	2.1	3.1	3.2	2.0	2.9	1.3	3.6	6.2	3.7	4.0	0.7
Vulva	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vagina	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cervix uteri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corpus uteri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uterus unspecified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ovary	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other female genital org.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Placenta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Penis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.2	0.7	0.4	0.3	0.0	0.0	6.1	0.1
Prostate	0.2	0.2	0.0	0.0	0.3	0.2	0.1	0.3	0.3	0.6	2.7	4.3	12.2	22.3	50.8	78.0	69.0	34.3	3.5
Testis	0.2	0.0	0.1	0.5	1.0	1.5	2.4	2.1	1.4	1.5	1.2	0.5	0.8	0.2	1.0	1.4	3.7	0.0	0.8
Other male genital organ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
Kidney	0.5	0.4	0.1	0.1	0.2	0.0	0.3	0.2	0.5	1.3	2.3	3.0	5.7	5.2	5.7	7.5	3.7	4.0	0.8
Renal pelvis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ureter	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
Bladder	0.1	0.0	0.2	0.1	0.5	0.4	1.0	1.7	2.4	8.3	10.2	15.1	25.1	36.7	52.9	83.5	50.3	36.3	4.7
Other urinary organs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.0	0.0	0.0	0.0
Eye	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.2	0.0	1.3	0.7	3.7	4.0	0.1
Brain, nervous system	0.4	1.0	0.7	0.7	1.0	0.7	2.0	1.6	2.1	4.1	4.5	5.7	3.9	6.0	5.7	7.5	3.7	4.0	1.7
Thyroid	0.0	0.0	0.0	0.0	0.3	0.2	0.8	0.7	0.8	0.9	1.5	1.4	1.5	1.5	1.8	3.4	1.9	2.0	0.5
Adrenal gland	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other endocrine	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.1
Hodgkin disease	0.3	0.6	0.6	0.8	1.4	0.9	1.0	1.4	1.3	1.5	2.0	2.5	1.8	1.7	1.3	3.4	1.9	0.0	1.1
Non-Hodgkin lymphoma	0.9	0.9	1.0	0.8	1.3	1.4	1.4	2.3	4.3	3.4	7.2	10.1	7.5	10.0	15.4	15.1	20.5	16.2	2.6
Immunoproliferative	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
Multiple myeloma	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.3	0.3	1.8	2.3	2.7	5.5	5.4	4.4	9.6	3.7	2.0	0.7
Lymphoid leukemia	0.0	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.3	1.1	1.5	1.6	2.4	3.1	2.9	6.8	7.5	4.0	0.5
Myeloid leukemia	0.0	0.1	0.0	0.2	0.3	0.2	0.6	0.2	0.6	0.4	0.5	0.5	0.8	0.6	0.0	1.4	0.0	2.0	0.3
Leukemia unspecified	2.3	2.8	2.0	2.0	1.7	1.2	1.6	0.9	1.3	1.6	1.3	2.7	3.1	2.7	5.2	6.2	7.5	4.0	2.2
Other and unspecified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All sites	6.8	7.5	6.7	8.8	13.9	15.2	25.1	30.6	59.0	97.6	162.8	198.9	334.0	427.3	622.9	885.1	764.1	419.9	66.1
All sites excluding skin	6.5	7.2	6.4	8.4	13.2	14.0	22.9	27.6	49.1	81.8	140.9	177.1	308.3	383.9	566.1	783.8	635.5	341.2	59.2

Appendix Table 7. Age-specific incidence rates, female (before correction for elderly ages)

Sites	Age-specific incidence rates (per 100,000 person-years)																		
	0–4	5–9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	Total
Lip	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.9	2.2	1.6	2.1	2.9	3.6	1.5	0.2
Tongue	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.2	0.7	0.8	0.2	3.1	0.7	3.9	3.6	1.8	3.0	0.3
Mouth	0.0	0.0	0.1	0.0	0.0	0.1	0.2	0.1	0.2	0.1	1.5	0.4	1.7	2.8	2.1	5.8	1.8	0.0	0.3
Salivary glands	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1	0.4	0.7	0.6	0.4	0.2	0.6	0.0	0.0	0.0	0.1
Tonsil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.5	0.6	0.7	0.0	0.0	0.0
Other oropharynx	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nasopharynx	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.4	0.5	0.5	1.0	0.2	0.9	0.9	0.6	0.0	0.0	0.0	0.2
Hypopharynx	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	1.2	0.4	0.2	1.2	2.7	0.7	0.0	0.0	0.1
Pharynx unspecified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.1	0.7	0.9	0.7	1.4	0.6	0.0	0.0	0.0	0.1
Esophagus	0.0	0.0	0.0	0.1	0.1	0.4	0.9	1.6	5.9	9.9	19.2	23.5	41.3	40.0	52.7	58.9	59.1	35.9	5.4
Stomach	0.1	0.1	0.1	0.4	0.4	0.7	2.2	2.7	6.2	8.1	17.8	21.1	40.8	46.4	56.3	69.1	53.7	35.9	5.7
Small intestine	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.3	0.5	0.8	0.6	1.1	1.2	0.9	0.7	0.0	1.5	0.2
Colon	0.1	0.0	0.1	0.3	0.7	0.9	1.0	3.2	3.8	6.3	8.9	11.9	12.5	16.7	16.6	21.1	12.5	10.5	2.6
Rectum	0.0	0.0	0.0	0.0	0.3	0.5	0.6	1.2	1.8	2.5	4.9	7.2	8.3	4.9	8.7	8.7	19.7	7.5	1.3
Anus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.3	0.6	0.9	0.0	0.6	0.0	1.8	3.0	0.1
Liver	0.2	0.0	0.1	0.1	0.0	0.2	0.1	0.4	0.6	1.7	1.8	0.6	3.7	4.5	6.3	2.9	0.0	1.5	0.6
Gallbladder	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.7	0.8	1.6	1.5	5.9	4.2	10.2	10.2	7.2	1.5	0.7
Pancreas	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.4	0.4	0.6	1.8	1.5	1.3	4.7	7.2	8.0	7.2	9.0	0.5
Nose, sinuses	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.4	0.2	0.4	0.6	0.0	0.9	0.7	1.8	0.0	0.1
Larynx	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.4	0.3	0.5	1.2	1.5	1.5	1.9	3.3	1.5	1.8	0.0	0.3
Trachea, bronchus & lung	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.6	1.0	1.8	2.3	3.8	4.6	8.5	12.9	13.1	7.2	1.5	1.0
Other thoracic organs	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.5	0.1	0.5	0.8	0.9	0.5	0.6	0.0	0.0	0.0	0.1
Bone	0.1	0.2	0.8	0.6	0.9	0.4	0.4	0.3	0.3	0.6	1.0	0.0	1.5	1.4	1.2	4.4	3.6	0.0	0.6
Melanoma of skin	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.5	0.5	0.3	1.7	1.1	0.9	2.7	4.4	7.2	3.0	0.3
Other skin	0.2	0.2	0.1	0.2	0.5	1.7	2.1	3.1	6.4	12.3	20.7	15.8	21.4	26.8	41.9	72.7	68.1	38.9	4.9
Mesothelioma	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Kaposi sarcoma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.3	1.5	3.6	0.0	0.0
Connective & soft tissue	0.1	0.1	0.0	0.2	0.2	0.4	0.3	0.4	0.7	0.5	1.8	0.6	0.7	2.1	1.2	0.7	1.8	1.5	0.4
Breast	0.1	0.0	0.0	0.3	1.1	4.1	11.3	18.8	33.1	35.7	37.0	29.0	26.4	22.8	26.8	37.8	26.9	15.0	9.2
Vulva	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.4	0.6	0.5	0.9	0.7	1.8	0.0	0.1
Vagina	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.5	0.5	0.6	0.9	1.9	0.6	1.5	0.0	0.0	0.2
Cervix uteri	0.0	0.0	0.0	0.0	0.1	0.2	1.5	2.7	3.2	4.4	8.6	7.7	5.9	6.1	3.3	10.2	5.4	3.0	1.4
Corpus uteri	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.4	0.8	1.1	3.3	3.8	4.8	5.9	1.8	3.6	3.6	1.5	0.6
Uterus unspecified	0.0	0.0	0.0	0.0	0.1	0.6	0.6	0.6	1.7	2.4	3.0	2.1	3.7	3.3	2.4	1.5	1.8	3.0	0.7
Ovary	0.0	0.1	0.2	0.7	0.8	1.2	1.5	2.3	2.7	3.3	3.9	4.9	6.1	4.2	5.1	5.8	0.0	3.0	1.5
Other female genital org.	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.2	0.6	0.4	0.9	0.6	0.0	0.0	0.0	0.1
Placenta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kidney	0.7	0.2	0.0	0.1	0.1	0.1	0.2	0.3	0.7	1.1	1.5	1.3	2.0	2.1	1.8	3.6	5.4	0.0	0.5
Renal pelvis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ureter	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Bladder	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.4	0.7	1.1	2.5	3.6	6.5	7.1	10.2	11.6	10.7	9.0	1.0
Other urinary organs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Eye	0.2	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.0	0.7	0.4	0.2	0.2	0.9	2.9	0.0	0.0	0.1
Brain, nervous system	0.5	0.9	0.6	0.7	0.8	0.9	1.3	1.7	1.7	2.4	3.5	4.7	5.9	3.1	4.2	2.9	0.0	1.5	1.4
Thyroid	0.0	0.0	0.2	0.3	0.7	1.4	2.2	2.4	3.8	3.2	2.8	2.6	2.6	4.7	5.7	3.6	1.8	0.0	1.5
Adrenal gland	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Other endocrine	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.2	0.4	0.2	0.2	0.0	0.0	0.0	0.0	0.0
Hodgkin disease	0.0	0.1	0.4	1.5	0.8	0.7	0.9	0.6	0.5	0.4	1.0	1.1	1.5	0.7	0.3	0.0	0.0	1.5	0.6
Non-Hodgkin lymphoma	0.1	0.6	0.4	0.5	0.7	0.9	1.3	0.9	1.4	1.7	3.3	2.8	5.3	3.5	8.7	5.8	10.7	4.5	1.3
Immunoproliferative	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Multiple myeloma	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.4	0.1	1.2	0.9	3.9	3.1	3.6	1.5	5.4	0.0	0.4
Lymphoid leukemia	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.3	0.5	0.6	0.3	0.8	1.3	2.4	1.5	2.2	5.4	0.0	0.3
Myeloid leukemia	0.1	0.0	0.1	0.2	0.1	0.4	0.2	0.1	0.2	0.4	0.5	0.4	1.1	0.2	0.6	1.5	1.8	0.0	0.2
Leukemia unspecified	1.9	1.4	1.3	1.1	1.0	0.5	0.6	0.9	1.8	1.9	2.6	2.1	2.0	2.8	4.5	6.5	9.0	0.0	1.5
Other and unspecified	0.4	0.6	0.6	0.8	1.2	1.1	1.4	1.6	3.2	4.7	4.8	6.6	8.5	11.3	11.4	17.4	14.3	10.5	2.3
All sites	5.7	5.0	5.6	8.7	11.6	19.1	33.8	50.3	87.8	114.6	173.1	173.4	248.3	261.5	333.1	413.0	367.1	207.9	51.0
All sites excluding skin	5.5	4.9	5.5	8.5	11.1	17.3	31.7	47.2	81.5	102.3	152.3	157.6	226.9	234.7	291.2	340.3	299.1	169.0	46.2

Age-specific incidence rate by province

Ardebil

Appendix Table 8. Age-specific incidence rates in Ardebil, male (corrected)

Sites	Crude age-specific incidence rates (per 100,000 person-years)																		Crude rate /100,000
	0–4	5–9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	
Lip	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tongue	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.00	1.22	0.00	0.00	0.00	3.36	3.63	8.06	9.46	11.30	12.79	0.47
Mouth	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.00	1.84	3.36	1.81	0.00	9.46	6.10	9.59	0.35
Salivary glands	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.00	1.49	0.00	0.00	0.00	1.81	0.00	0.00	0.00	0.00	0.13
Tonsil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.84	1.68	0.00	2.69	0.00	1.73	1.07	0.13
Other oropharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nasopharynx	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.87	0.00	0.00	0.00	1.84	3.36	1.81	0.00	0.00	0.00	0.00	0.25
Hypopharynx	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.87	0.00	0.00	3.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
Pharynx unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.67	5.03	7.25	0.00	18.92	12.20	19.18	0.51
Esophagus	0.00	0.00	0.00	0.00	0.00	0.56	1.49	1.74	9.76	14.87	31.10	34.88	85.58	77.94	136.98	227.01	234.81	284.63	10.39
Stomach	0.00	0.00	0.27	0.00	2.60	2.79	6.71	9.57	12.19	34.21	84.66	124.83	244.98	286.40	370.65	681.04	678.43	837.87	32.09
Small intestine	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.84	0.00	1.81	0.00	0.00	0.00	0.00	0.13
Colon	0.00	0.00	0.00	0.00	0.52	2.79	2.98	1.74	4.88	13.39	5.18	9.18	16.78	21.75	45.66	66.21	72.17	85.29	3.52
Rectum	0.00	0.00	0.00	0.00	0.52	1.67	1.49	0.87	1.22	1.49	3.46	1.84	5.03	0.00	2.69	0.00	1.73	1.07	0.68
Anus	0.00	0.00	0.00	0.00	0.00	0.56	0.00	1.74	1.22	1.49	1.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
Liver	0.00	0.00	0.00	0.00	0.00	1.11	0.75	1.74	0.00	5.95	0.00	0.00	3.36	9.06	21.49	9.46	19.96	18.13	1.24
Gallbladder	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.22	0.00	1.73	1.84	1.68	1.81	10.74	0.00	6.93	4.27	0.42
Pancreas	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.00	1.73	3.67	1.68	7.25	5.37	9.46	9.57	11.73	0.51
Nose, sinuses	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	1.73	0.00	0.00	1.81	2.69	0.00	1.73	1.07	0.17
Larynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.22	0.00	1.73	7.34	5.03	5.44	13.43	0.00	8.66	5.34	0.72
Lung, trachea & bronchus	0.00	0.00	0.00	0.68	0.00	0.56	2.24	0.87	0.00	10.41	13.82	20.19	38.59	54.38	61.77	75.67	88.66	101.28	5.13
Other thoracic organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.00	1.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Bone	0.00	0.00	0.81	0.68	1.56	1.67	0.75	1.74	2.44	2.97	1.73	7.34	6.71	5.44	8.06	18.92	17.40	22.38	1.66
Melanoma of skin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.00	0.00	1.84	1.68	3.63	0.00	0.00	0.00	0.00	0.21
Other skin	0.37	1.08	0.00	0.34	0.52	0.56	3.73	5.22	17.07	16.36	22.46	33.04	46.98	39.88	77.89	151.34	147.87	184.41	9.00
Mesothelioma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kaposi sarcoma	0.00	0.00	0.00	0.00	0.52	0.00	0.75	0.00	0.00	1.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
Connective & soft tissue	0.00	0.00	0.00	0.34	1.04	0.56	0.75	0.00	3.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43
Breast	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	1.22	2.97	1.73	1.84	1.68	1.81	0.00	9.46	6.10	9.59	0.38
Vulva	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vagina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cervix uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Corpus uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uterus unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ovary	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other female genitalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Placenta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Penis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.73	0.00	0.00	0.00	2.69	0.00	1.73	1.07	0.08
Prostate	0.00	0.00	0.00	0.00	1.04	0.56	0.00	0.00	1.22	0.00	5.18	5.51	10.07	14.50	59.09	94.59	99.14	119.40	2.94
Testis	0.00	0.00	0.54	0.34	1.56	2.23	2.24	3.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72
Other male genitalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kidney	0.37	0.27	0.27	0.34	0.52	0.00	0.75	2.61	1.22	2.97	6.91	11.01	10.07	5.44	8.06	9.46	11.30	12.79	1.61
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ureter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bladder	0.00	0.27	0.27	0.34	0.52	0.00	0.75	1.74	6.10	5.95	15.55	20.19	35.24	32.63	61.77	104.05	106.97	130.06	5.04
Other urinary organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eye	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Brain, nervous system	0.37	1.90	0.54	0.34	2.60	0.56	2.24	3.48	6.10	8.92	5.18	12.85	11.75	10.88	10.74	28.38	25.24	33.04	2.84
Thyroid	0.00	0.27	0.00	0.00	0.00	0.00	0.00	1.74	0.00	2.97	0.00	3.67	1.68	1.81	2.69	0.00	1.73	1.07	0.42
Adrenal gland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other endocrine	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00	1.22	1.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23
Hodgkin disease	0.00	0.00	0.00	0.00	1.04	1.67	0.75	0.00	0.00	0.00	1.73	0.00	0.00	1.81	2.69	0.00	1.73	1.07	0.38
Non-Hodgkin lymphoma	0.37	0.00	0.27	0.34	1.04	0.00	0.00	0.00	2.44	2.97	8.64	22.03	3.36	12.69	10.74	0.00	6.93	4.27	1.92
Immunoproliferative	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple myeloma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.36	1.81	0.00	0.00	0.00	0.00	0.23
Lymphoid leukemia	0.00	0.81	0.27	0.00	0.52	0.00	0.00	0.00	0.00	0.00	3.46	1.84	1.68	0.00	0.00	0.00	0.00	0.00	0.38
Myeloid leukemia	0.37	0.27	0.00	0.34	0.00	0.00	0.00	0.87	0.00	0.00	0.00	0.00	3.36	0.00	0.00	0.00	0.00	0.00	0.25
Leukemia unspecified	0.00	0.54	0.27	0.00	1.04	0.00	1.49	0.00	1.22	1.49	1.73	5.51	0.00	0.00	2.69	0.00	1.73	1.07	0.59
Other and unspecified	1.12	1.63	2.69	3.04	1.04	1.67	3.73	1.74	3.66	10.41	6.91	12.85	18.46	32.63	29.54	56.75	55.67	69.29	4.96
All sites	2.98	7.59	6.19	7.09	19.77	21.73	35.06	44.36	80.48	144.28	234.99	354.28	575.54	648.93	958.85	1579.64	1637.54	1982.82	91.82
All sites excluding skin	2.60	6.50	6.19	6.76	19.25	21.17	31.33	39.14	63.41	127.92	212.52	321.24	528.56	609.05	880.96	1428.30	1489.67	1798.41	82.85

Appendix Table 9. Age-specific incidence rates in Ardebil, female (corrected)

Sites	Age-specific incidence rates (per 100,000 person-years)																		Crude rate (/100,000)
	0–4	5-9	10–14	15-19	20–24	25-29	30–34	35-39	40–44	45-49	50–54	55-59	60–64	65-69	70–74	75-79	80–84	85+	
Lip	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tongue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.03	0.00	10.25	25.71	23.20	30.14	0.39
Mouth	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Salivary glands	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.00	2.03	2.36	0.00	0.00	0.00	0.00	0.17
Tonsil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.05	0.00	0.00	0.00	12.85	8.29	13.03	0.13
Other oropharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nasopharynx	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00	1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Hypopharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Pharynx unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06	0.00	0.00	0.00	6.08	4.73	0.00	0.00	0.00	0.00	0.26
Esophagus	0.00	0.00	0.00	0.67	0.47	1.16	2.23	2.55	10.63	21.87	49.26	34.44	66.89	70.92	85.45	128.53	138.04	164.30	9.17
Stomach	0.00	0.29	0.28	1.34	0.93	0.58	3.71	6.81	24.44	23.24	69.64	87.10	121.62	108.74	140.14	308.48	289.40	368.49	14.57
Small intestine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Colon	0.00	0.00	0.00	0.34	0.00	1.16	0.74	2.55	1.06	5.47	11.89	8.10	18.24	11.82	20.51	38.56	38.10	47.25	2.08
Rectum	0.00	0.00	0.00	0.00	0.00	0.58	0.74	0.85	1.06	2.73	3.40	2.03	6.08	9.46	6.84	0.00	4.41	2.72	0.86
Anus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.37	1.70	2.03	2.03	0.00	3.42	0.00	2.20	1.36	0.30
Liver	0.00	0.00	0.00	0.00	0.00	0.58	0.00	1.70	2.13	5.47	1.70	2.03	14.19	16.55	17.09	0.00	11.02	6.79	1.34
Gallbladder	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.10	5.10	4.05	10.14	4.73	20.51	12.85	21.52	21.19	1.12
Pancreas	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00	1.37	3.40	8.10	2.03	4.73	3.42	0.00	2.20	1.36	0.52
Nose, sinuses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.85	8.29	13.03	0.04
Larynx	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.85	1.06	0.00	0.00	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.17
Lung	0.00	0.00	0.00	0.00	0.47	0.00	0.00	1.70	2.13	4.10	6.79	10.13	8.11	14.18	37.60	12.85	32.55	27.98	1.82
Other thoracic organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.00	0.00	0.00	3.42	0.00	2.20	1.36	0.09
Bone	0.40	0.29	1.39	0.67	0.93	0.58	0.74	0.00	1.06	2.73	6.79	0.00	6.08	2.36	6.84	0.00	4.41	2.72	1.12
Melanoma of skin	0.00	0.00	0.00	0.34	0.47	0.00	0.74	0.00	0.00	0.00	0.00	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.17
Other skin	0.40	0.00	0.28	0.34	2.34	5.23	2.97	7.66	7.44	9.57	20.38	22.28	28.38	26.00	75.20	51.41	81.68	82.03	5.67
Mesothelioma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kaposi sarcoma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Connective & soft tissue	0.40	0.29	0.00	0.00	0.00	0.58	0.00	0.85	0.00	0.00	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
Breast	0.00	0.00	0.00	0.67	1.40	1.16	3.71	10.22	18.07	17.77	8.49	16.20	24.32	18.91	27.34	89.97	75.68	102.10	4.67
Vulva	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.73	0.00	0.00	0.00	0.00	0.09
Vagina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.00	4.05	0.00	0.00	0.00	0.00	0.00	0.13
Cervix uteri	0.00	0.00	0.00	0.00	0.00	0.00	1.48	0.85	1.06	1.37	3.40	2.03	0.00	2.36	0.00	12.85	8.29	13.03	0.48
Corpus uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.73	0.00	4.05	0.00	2.36	0.00	0.00	0.00	0.00	0.22
Uterus unspecified	0.00	0.00	0.00	0.00	0.00	2.32	2.97	1.70	6.38	13.67	3.40	10.13	18.24	9.46	10.25	12.85	14.91	17.11	2.21
Ovary	0.00	0.00	0.28	0.34	0.00	0.58	2.23	0.00	3.19	5.47	1.70	2.03	4.05	0.00	17.09	0.00	11.02	6.79	1.04
Other female genitalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Placenta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Kidney	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ureter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bladder	0.00	0.00	0.00	0.00	0.00	0.00	0.74	0.85	0.00	2.73	1.70	6.08	16.22	7.09	27.34	12.85	25.93	23.90	1.25
Other urinary organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.03	0.00	0.00	0.00	0.00	0.00	0.04
Eye	0.40	0.29	0.00	0.34	0.00	0.00	0.00	0.00	1.06	0.00	0.00	0.00	0.00	0.00	6.84	0.00	4.41	2.72	0.26
Brain, nervous system	0.40	1.43	0.83	0.34	0.93	0.00	2.23	3.41	2.13	2.73	5.10	12.15	14.19	9.46	10.25	12.85	14.91	17.11	2.03
Thyroid	0.00	0.00	0.00	0.34	0.47	0.58	2.97	2.55	1.06	1.37	1.70	4.05	0.00	4.73	0.00	0.00	0.00	0.00	0.95
Adrenal gland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other endocrine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.03	0.00	0.00	0.00	0.00	0.00	0.04
Hodgkin disease	0.00	0.29	0.28	1.01	0.47	0.58	0.74	0.85	1.06	0.00	0.00	0.00	0.00	2.36	0.00	0.00	0.00	0.00	0.48
Non-Hodgkin lymphoma	0.40	0.29	0.83	0.67	0.47	0.00	0.00	1.70	0.00	0.00	1.70	4.05	0.00	0.00	0.00	0.00	0.00	0.00	0.65
Immunoproliferative	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple myeloma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06	0.00	0.00	0.00	0.00	2.36	0.00	0.00	0.00	0.00	0.09
Lymphoid leukemia	0.40	0.00	0.00	0.00	0.47	0.00	0.00	0.00	2.13	0.00	1.70	0.00	0.00	2.36	0.00	0.00	0.00	0.00	0.26
Myeloid leukemia	0.79	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.03	0.00	0.00	0.00	0.00	0.00	0.22
Leukemia unspecified	0.00	0.29	0.28	0.00	0.93	0.00	0.00	0.00	3.19	2.73	3.40	0.00	2.03	2.36	3.42	0.00	2.20	1.36	0.65
Other and unspecified	0.79	0.86	0.56	2.01	3.74	1.74	1.48	2.55	6.38	12.30	6.79	8.10	12.16	14.18	13.67	38.56	33.69	44.53	4.41
All sites	4.75	4.58	5.00	10.06	14.49	18.58	30.44	51.08	98.83	146.27	232.69	257.25	395.28	359.30	546.90	784.06	858.58	1012.40	60.76
All sites excluding skin	4.36	4.58	4.73	9.73	12.15	13.35	27.47	43.42	91.39	136.70	212.31	234.97	366.90	333.30	471.70	732.65	776.90	930.37	55.10

Gilan

Appendix Table 10. Age-specific incidence rates in Gilan, male (corrected)

Sites	Age-specific incidence rates (per 100,000 person-years)																		Crude rate (/100,000)
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	
Lip	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.34	0.89	2.96	4.27	2.73	5.52	7.25	0.00	4.68	2.88	0.66
Tongue	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.69	0.00	0.00	0.00	0.00	0.05
Mouth	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.69	0.45	0.00	1.83	2.73	0.00	4.53	5.31	6.35	7.19	0.38
Salivary glands	0.00	0.00	0.00	0.00	0.49	0.22	0.00	0.00	0.00	0.00	0.00	1.22	1.09	0.69	0.91	0.00	0.58	0.36	0.18
Tonsil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.69	0.91	0.00	0.58	0.36	0.05
Other oropharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.58	0.36	0.02
Nasopharynx	0.00	0.00	0.00	0.00	0.49	0.00	0.50	0.00	0.34	0.45	2.96	0.61	1.64	2.76	1.81	2.66	2.88	3.41	0.39
Hypopharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.89	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.00	0.09
Pharynx unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00	1.18	0.00	1.64	1.38	1.81	0.00	1.17	0.72	0.20
Esophagus	0.00	0.15	0.25	0.16	0.25	0.90	1.00	3.36	1.72	7.16	17.15	17.08	43.13	42.78	58.03	132.80	123.11	157.72	6.83
Stomach	0.00	0.00	0.00	0.31	0.25	2.01	5.24	6.16	8.25	21.48	36.08	49.41	107.01	111.77	176.82	236.39	266.56	309.97	18.27
Small intestine	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.28	0.69	0.45	1.18	0.61	2.18	3.45	6.35	7.97	9.23	10.60	0.56
Colon	0.41	0.15	0.37	0.78	1.23	0.90	1.25	1.40	5.16	8.95	5.92	14.03	14.74	23.46	24.48	21.25	29.50	31.28	3.87
Rectum	0.00	0.00	0.00	0.00	0.49	1.34	0.75	0.84	2.41	4.92	5.32	5.49	5.46	9.66	15.42	31.87	30.50	38.44	2.03
Anus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.59	0.61	1.09	0.69	0.00	0.00	0.00	0.00	0.13
Liver	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.28	0.34	1.34	2.96	1.83	7.64	7.59	6.35	18.59	16.09	21.37	1.08
Gallbladder	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.45	1.18	0.61	2.73	0.69	0.00	2.66	1.71	2.69	0.30
Pancreas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03	1.34	4.14	2.44	6.55	9.66	7.25	13.28	13.25	16.35	1.22
Nose, sinuses	0.00	0.15	0.12	0.00	0.00	0.00	0.00	0.56	0.00	0.45	0.00	1.83	0.00	0.69	2.72	2.66	3.47	3.77	0.25
Larynx	0.00	0.15	0.00	0.00	0.25	0.00	0.25	0.28	1.03	2.68	7.10	5.49	12.01	15.18	12.69	13.28	16.76	18.51	1.79
Lung	0.00	0.00	0.00	0.00	0.00	0.22	0.75	1.12	1.38	4.47	5.32	11.59	21.84	33.12	43.53	42.50	55.49	60.39	4.00
Other thoracic organs	0.00	0.15	0.00	0.00	0.25	0.00	0.00	0.00	0.34	0.45	0.00	0.61	2.73	1.38	2.72	2.66	3.47	3.77	0.30
Bone	0.00	0.15	0.25	1.24	0.98	0.67	0.50	0.28	0.00	0.45	2.37	1.22	2.73	2.07	2.72	7.97	6.89	9.16	0.77
Melanoma of skin	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.69	0.00	0.59	0.00	3.28	0.00	2.72	0.00	1.75	1.08	0.23
Other skin	0.41	0.15	0.37	0.47	0.98	0.90	1.75	4.20	11.00	21.93	18.34	22.57	22.38	42.78	49.87	98.27	95.57	119.47	7.51
Mesothelioma	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91	2.66	2.30	3.05	0.05
Kaposi sarcoma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.00	0.00	0.00	0.55	2.76	0.00	5.31	3.43	5.39	0.18
Connective & soft tissue	0.00	0.15	0.12	0.16	0.00	0.00	0.25	0.00	0.34	0.89	2.37	1.22	2.73	1.38	0.91	2.66	2.30	3.05	0.41
Breast	0.00	0.00	0.00	0.16	0.00	0.22	1.50	1.12	2.41	4.03	5.92	2.44	2.18	1.38	2.72	7.97	6.89	9.16	1.00
Penis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.00	0.05
Prostate	0.00	0.00	0.00	0.16	0.49	0.00	0.25	0.00	0.00	0.45	1.77	4.27	14.19	19.32	58.03	108.90	107.68	133.48	5.88
Testis	0.20	0.00	0.00	0.62	1.97	1.79	2.99	3.36	1.72	2.68	2.37	0.61	1.64	0.69	0.00	5.31	3.43	5.39	1.29
Other male genitalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kidney	0.20	0.44	0.00	0.00	0.00	0.00	1.00	0.00	0.34	0.89	4.14	3.05	7.10	4.83	7.25	21.25	18.39	24.43	1.13
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ureter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Bladder	0.20	0.00	0.37	0.16	0.49	0.00	0.25	2.24	2.06	8.05	14.20	20.74	37.12	47.61	67.10	98.27	106.68	126.32	6.80
Other urinary organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eye	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.58	0.36	0.05
Brain, nervous system	0.61	0.74	0.25	0.16	0.49	0.45	1.25	0.56	1.38	2.68	1.77	3.05	1.09	2.76	1.81	2.66	2.88	3.41	0.93
Thyroid	0.00	0.00	0.00	0.00	0.25	0.22	1.50	0.84	0.34	0.89	1.77	3.05	2.18	1.38	1.81	0.00	1.17	0.72	0.70
Adrenal gland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other endocrine	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Hodgkin disease	0.00	0.29	0.37	1.09	1.23	0.00	0.75	1.40	0.34	0.45	1.77	3.66	1.64	2.07	0.91	0.00	0.58	0.36	0.82
Non-Hodgkin lymphoma	0.81	0.88	0.62	0.62	0.49	1.34	0.75	2.52	4.13	2.24	3.55	8.54	3.82	3.45	13.60	15.94	19.05	21.57	2.08
Immunoproliferative	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Multiple myeloma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.69	1.79	2.37	1.22	5.46	6.21	10.88	7.97	12.16	12.41	0.91
Lymphoid leukemia	0.00	0.29	0.12	0.16	0.00	0.22	0.00	0.00	0.00	0.45	1.18	0.00	0.00	2.76	1.81	5.31	4.60	6.11	0.32
Myeloid leukemia	0.00	0.00	0.00	0.00	0.49	0.22	0.00	0.00	0.00	0.89	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.11
Leukemia unspecified	3.85	3.83	2.00	1.71	1.23	1.12	2.00	0.56	1.03	0.45	1.18	2.44	1.64	1.38	6.35	2.66	5.81	5.22	2.17
Other and unspecified	0.41	1.18	0.50	0.62	1.48	1.34	3.24	1.68	3.78	5.82	11.24	8.54	13.65	20.01	21.76	47.81	44.88	57.13	3.91
All sites	7.09	8.85	5.74	8.70	14.76	14.10	29.44	34.13	55.37	111.86	170.96	206.77	361.42	436.06	626.59	974.77	1033.01	1237.44	80.08
All sites excluding skin	6.69	8.70	5.36	8.23	13.78	13.21	27.69	29.94	44.36	89.94	152.62	184.20	339.04	393.28	576.71	876.49	937.44	1117.97	72.57

Appendix Table 11. Age-specific incidence rates in Gilan, female (corrected)

Sites	Age-specific incidence rates (per 100,000 person-years)																		Crude rate (/100,000)
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	
Lip	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.74	0.97	2.36	2.15	2.77	0.07
Tongue	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.28	0.34	1.33	0.59	0.00	5.47	0.00	0.97	0.00	0.62	0.39	0.34
Mouth	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.59	0.00	3.65	0.00	1.94	7.07	5.81	7.94	0.23
Salivary glands	0.00	0.00	0.00	0.00	0.20	0.21	0.25	0.00	0.00	0.00	0.59	0.63	0.61	0.00	0.00	0.00	0.00	0.00	0.12
Tonsil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	1.47	0.00	0.00	0.00	0.00	0.05
Other oropharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nasopharynx	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.28	0.68	0.89	0.59	0.63	0.61	1.47	0.00	0.00	0.00	0.00	0.20
Hypopharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.74	4.84	0.00	3.12	1.93	0.14
Pharynx unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.00	1.76	0.63	0.61	0.74	0.00	0.00	0.00	0.00	0.12
Esophagus	0.00	0.00	0.00	0.00	0.00	0.43	0.50	1.66	3.40	6.20	12.87	13.28	30.41	24.27	34.87	40.07	48.34	54.49	4.14
Stomach	0.00	0.00	0.00	0.59	0.80	1.29	2.49	3.32	5.43	10.63	12.29	15.81	39.54	48.54	60.05	82.49	91.95	107.51	6.87
Small intestine	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.55	0.34	0.89	0.00	0.63	2.43	0.74	0.00	0.00	0.00	0.00	0.23
Colon	0.21	0.00	0.26	0.45	1.39	1.50	0.75	4.71	4.75	8.42	8.78	13.92	17.03	22.06	24.22	37.71	39.95	47.86	4.14
Rectum	0.00	0.00	0.00	0.00	0.60	0.64	0.50	0.55	2.04	3.54	6.44	6.33	8.52	3.68	15.50	11.78	17.60	18.11	1.78
Anus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Liver	0.21	0.00	0.26	0.00	0.00	0.21	0.25	0.55	0.68	3.54	1.76	1.27	2.43	5.88	5.81	2.36	5.27	4.70	0.78
Gallbladder	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	1.36	0.44	1.17	2.53	1.22	2.94	5.81	16.50	14.39	19.04	0.57
Pancreas	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.28	1.02	1.33	0.59	1.27	1.22	4.41	9.69	9.43	12.33	13.41	0.71
Nose, sinuses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.59	0.63	0.00	0.00	0.97	0.00	0.62	0.39	0.11
Larynx	0.00	0.00	0.00	0.00	0.20	0.00	0.50	0.28	0.34	0.89	0.59	1.90	1.22	2.21	2.91	2.36	3.39	3.54	0.37
Lung	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.44	1.76	5.06	4.26	6.62	7.75	7.07	9.56	10.25	0.82
Other thoracic organs	0.00	0.00	0.00	0.00	0.20	0.00	0.25	0.00	0.68	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.11
Bone	0.00	0.31	0.39	0.59	0.80	0.00	0.50	0.28	0.34	0.89	0.00	0.00	1.22	1.47	0.00	4.71	3.04	4.78	0.44
Melanoma of skin	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.83	0.00	0.89	0.00	0.00	0.61	2.21	1.94	0.00	1.25	0.77	0.23
Other skin	0.42	0.31	0.13	0.30	0.20	0.86	3.49	2.49	5.09	11.96	16.97	10.12	16.42	20.59	35.84	70.70	68.73	85.94	4.86
Mesothelioma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.04
Kaposi sarcoma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.00	0.97	4.71	3.67	5.16	0.11
Connective & soft tissue	0.21	0.31	0.00	0.15	0.00	0.00	0.25	0.00	0.34	0.89	1.17	0.00	1.82	2.94	1.94	0.00	1.25	0.77	0.53
Breast	0.00	0.00	0.00	0.30	0.60	3.44	11.72	17.99	32.26	36.32	35.69	38.58	23.72	14.71	24.22	37.71	39.95	47.86	10.16
Vulva	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Vagina	0.21	0.00	0.13	0.00	0.00	0.00	0.25	0.00	0.00	0.89	0.59	0.63	0.61	2.21	0.00	2.36	1.52	2.39	0.21
Cervix uteri	0.00	0.00	0.00	0.00	0.00	0.21	1.25	2.77	2.72	4.87	4.68	8.86	6.69	3.68	0.97	4.71	3.67	5.16	1.42
Corpus uteri	0.00	0.00	0.00	0.00	0.00	0.21	0.50	1.11	1.36	2.21	5.85	8.22	8.52	4.41	3.87	4.71	5.54	6.32	1.23
Uterus unspecified	0.00	0.00	0.13	0.00	0.20	0.64	0.50	0.55	2.38	1.33	2.34	0.63	1.82	2.21	2.91	0.00	1.87	1.16	0.64
Ovary	0.00	0.15	0.13	0.45	1.79	1.72	2.24	2.21	3.06	2.66	4.10	8.86	7.91	5.15	2.91	7.07	6.44	8.32	1.86
Other female genitalia	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.63	0.00	0.74	0.97	0.00	0.62	0.39	0.11
Placenta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kidney	0.21	0.00	0.00	0.00	0.20	0.21	0.25	0.28	1.70	1.33	1.76	1.90	4.26	3.68	4.84	4.71	6.16	6.70	0.80
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ureter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bladder	0.21	0.15	0.00	0.00	0.20	0.43	0.25	0.28	0.68	1.33	2.34	3.80	6.08	9.56	7.75	14.14	14.12	17.42	1.21
Other urinary organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.04
Eye	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.00	0.59	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Brain, nervous system	0.63	0.77	1.03	0.59	0.60	1.29	0.75	1.11	2.04	0.89	4.10	3.80	4.26	2.94	3.87	0.00	2.50	1.54	1.30
Thyroid	0.00	0.00	0.00	0.45	0.99	1.93	3.49	3.32	4.08	3.10	2.93	3.80	3.65	4.41	9.69	2.36	7.77	6.24	2.43
Adrenal gland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.02
Other endocrine	0.00	0.00	0.00	0.00	0.00	0.21	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Hodgkin disease	0.21	0.00	0.13	1.04	1.19	0.86	0.25	0.83	0.68	0.00	0.59	1.27	0.61	0.74	0.00	0.00	0.00	0.00	0.55
Non-Hodgkin lymphoma	0.00	0.15	0.13	0.15	0.20	0.86	0.75	0.28	0.68	0.44	2.93	1.90	3.04	1.47	4.84	0.00	3.12	1.93	0.82
Immunoproliferative	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple myeloma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	1.17	1.27	1.82	3.68	3.87	0.00	2.50	1.54	0.34
Lymphoid leukemia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.44	0.00	1.27	0.00	1.47	0.00	0.00	0.00	0.00	0.16
Myeloid leukemia	0.00	0.15	0.00	0.00	0.00	0.00	0.50	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.62	0.39	0.09
Leukemia unspecified	3.38	1.38	1.55	0.59	0.60	0.64	0.75	0.00	0.68	1.33	0.59	1.90	0.61	1.47	1.94	7.07	5.81	7.94	1.33
Other and unspecified	0.21	0.31	0.52	0.45	0.99	0.64	1.50	3.32	4.75	3.10	5.85	4.43	6.08	14.71	10.65	14.14	16.00	18.57	2.34
All sites	6.13	3.98	4.79	6.09	12.14	19.13	36.92	51.48	84.90	114.72	147.45	168.25	222.02	230.94	301.24	398.30	451.26	523.61	55.32
All sites excluding skin	5.71	3.68	4.66	5.80	11.94	18.27	33.43	48.99	79.81	102.76	130.49	158.13	205.60	210.35	265.40	327.60	382.53	437.67	50.46

Mazandaran

Appendix Table 12. Age-specific incidence rates in Mazandaran, male (corrected)

Sites	Age-specific incidence rates (per 100,000 person-years)																		Crude rate (/100,000)
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	
Lip	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.48	0.00	0.40	1.11	1.21	1.73	2.37	1.82	14.98	10.84	15.91	0.45
Tongue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	1.59	0.56	1.21	2.89	1.58	3.64	2.14	3.73	3.62	0.34
Mouth	0.00	0.12	0.00	0.00	0.00	0.00	0.21	0.00	0.31	1.19	2.23	0.61	1.73	0.00	3.64	0.00	2.35	1.45	0.31
Salivary glands	0.18	0.00	0.00	0.13	0.00	0.00	0.21	0.24	0.00	0.40	0.56	1.21	1.15	1.58	0.91	0.00	0.59	0.36	0.20
Tonsil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other oropharynx	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Nasopharynx	0.53	0.00	0.20	0.27	0.79	0.19	0.42	0.48	1.86	3.58	2.23	1.82	2.89	2.37	4.55	6.42	7.08	8.32	0.94
Hypopharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.62	0.00	1.11	0.00	0.00	0.79	1.82	0.00	1.17	0.72	0.15
Pharynx unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	1.58	0.00	2.14	1.38	2.17	0.08
Esophagus	0.53	0.00	0.00	0.27	0.00	0.76	1.68	1.91	4.33	7.57	18.38	18.20	45.59	60.81	137.50	145.52	182.57	202.21	8.91
Stomach	0.71	0.48	0.60	0.53	0.79	1.72	1.05	2.39	7.73	11.55	28.40	46.72	69.84	119.25	173.01	179.76	227.56	251.04	13.79
Small intestine	0.00	0.00	0.10	0.00	0.00	0.19	0.00	0.24	0.62	0.00	1.11	2.43	1.15	1.58	0.91	4.28	3.35	4.70	0.31
Colon	0.35	0.00	0.30	0.40	1.39	0.95	2.72	2.86	4.64	3.98	8.91	12.13	7.50	7.11	18.21	19.26	24.17	26.77	2.79
Rectum	0.00	0.00	0.00	0.00	0.20	0.57	0.84	1.19	3.40	3.19	5.01	1.82	4.62	8.69	10.02	32.10	27.17	36.53	1.73
Anus	0.00	0.00	0.00	0.00	0.20	0.19	0.84	0.00	0.00	0.80	0.00	1.82	0.00	0.00	1.82	2.14	2.56	2.89	0.22
Liver	0.00	0.12	0.00	0.00	0.20	0.19	0.21	0.00	0.00	0.40	3.34	3.03	0.58	5.53	5.46	8.56	9.05	10.85	0.68
Gallbladder	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.24	0.80	0.56	0.00	2.89	10.27	4.55	10.70	9.84	12.66	0.60
Pancreas	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.48	0.62	1.59	0.00	1.21	2.89	11.06	7.28	10.70	11.60	13.74	0.85
Nose, sinuses	0.18	0.00	0.10	0.00	0.00	0.00	0.42	0.24	0.31	0.40	0.56	1.21	1.73	0.79	0.91	0.00	0.59	0.36	0.25
Larynx	0.00	0.00	0.00	0.00	0.00	0.57	0.21	0.48	2.16	3.58	3.34	6.67	17.89	18.95	20.03	47.08	43.29	55.70	2.65
Lung	0.18	0.24	0.00	0.00	0.20	0.38	1.05	0.24	2.47	4.38	10.02	9.10	29.43	45.01	74.67	98.44	111.67	129.49	5.46
Other thoracic organs	0.18	0.12	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	1.82	0.00	0.79	0.00	2.14	1.38	2.17	0.12
Bone	0.18	0.00	0.70	2.14	0.20	0.19	0.42	0.00	0.31	0.00	0.56	2.43	1.15	1.58	0.91	0.00	0.59	0.36	0.66
Melanoma of skin	0.00	0.00	0.00	0.00	0.00	0.19	0.42	0.00	1.24	1.19	0.00	0.61	1.15	2.37	2.73	8.56	7.28	9.76	0.39
Other skin	0.35	0.12	0.30	0.40	0.79	1.53	1.89	0.95	6.80	10.75	24.50	16.38	17.31	45.01	44.62	85.60	84.00	104.53	6.28
Mesothelioma	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.59	0.36	0.03
Kaposi sarcoma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.31	0.00	0.56	0.00	1.15	0.79	0.00	0.00	0.00	0.00	0.09
Connective & soft tissue	0.18	0.00	0.10	0.40	0.40	0.00	0.21	0.48	0.62	2.79	2.23	0.61	2.89	3.16	1.82	4.28	3.94	5.06	0.77
Breast	0.18	0.00	0.00	0.00	0.00	0.00	0.21	0.95	2.78	4.78	2.23	1.82	4.04	1.58	5.46	6.42	7.67	8.68	0.88
Vulva	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vagina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cervix uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Corpus uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uterus unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ovary	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other female genitalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Placenta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Penis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.58	0.00	0.00	0.00	0.00	0.00	0.05
Prostate	0.88	0.48	0.10	0.00	0.00	0.19	0.00	0.48	0.62	1.19	2.78	3.03	12.70	31.59	45.53	59.92	68.02	78.85	3.28
Testis	0.18	0.12	0.00	0.80	0.79	1.53	2.72	1.43	1.55	0.80	1.11	0.61	0.58	0.00	1.82	0.00	1.17	0.72	0.88
Other male genitalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.59	0.36	0.02
Kidney	0.18	0.95	0.10	0.27	0.00	0.00	0.00	0.00	0.31	1.19	0.56	1.82	3.46	3.95	3.64	4.28	5.11	5.79	0.65
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ureter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bladder	0.00	0.00	0.20	0.00	0.79	0.38	0.84	1.43	2.16	10.35	6.13	9.71	16.16	25.27	49.17	74.90	80.04	95.49	4.21
Other urinary organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.59	0.36	0.02
Eye	0.18	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Brain, nervous system	0.18	0.95	1.10	1.47	1.98	0.95	2.30	1.67	2.78	4.78	6.13	6.07	3.46	7.90	10.93	10.70	13.95	15.19	2.33
Thyroid	0.18	0.00	0.00	0.00	0.79	0.57	0.42	0.24	0.93	0.00	1.67	0.61	0.58	2.37	0.00	2.14	1.38	2.17	0.42
Adrenal gland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other endocrine	0.00	0.24	0.00	0.00	0.20	0.19	0.21	0.24	0.00	0.00	0.00	1.21	0.58	0.00	0.00	0.00	0.00	0.00	0.14
Hodgkin disease	0.35	0.48	0.60	0.67	1.19	1.53	1.68	1.19	2.47	1.59	2.23	1.82	2.89	3.16	0.91	6.42	4.73	6.87	1.26
Non-Hodgkin lymphoma	1.24	0.48	1.31	1.20	1.19	2.29	2.30	2.62	3.71	3.19	6.13	6.07	7.50	12.64	11.84	10.70	14.54	15.55	2.78
Immunoproliferative	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple myeloma	0.35	0.00	0.10	0.13	0.20	0.00	0.21	0.24	0.00	2.39	3.34	3.64	5.77	5.53	3.64	6.42	6.49	7.96	0.79
Lymphoid leukemia	0.00	0.36	0.30	0.27	0.20	0.00	0.00	0.00	0.31	0.40	1.67	1.21	2.89	4.74	3.64	4.28	5.11	5.79	0.57
Myeloid leukemia	0.00	0.12	0.00	0.40	0.20	0.00	0.63	0.00	0.62	0.00	0.00	0.00	0.58	1.58	0.00	4.28	2.76	4.34	0.26
Leukemia unspecified	1.95	4.05	2.21	3.21	2.98	1.72	1.26	1.19	1.55	1.59	0.00	3.64	4.62	7.11	6.37	8.56	9.63	11.21	2.81
Other and unspecified	1.59	0.48	0.20	0.13	0.79	0.76	1.68	1.67	2.78	0.80	8.35	11.53	7.50	16.58	21.85	19.26	26.52	28.22	2.87
All sites	###	9.88	8.84	13.10	16.47	18.12	27.65	26.71	62.77	93.18	158.14	185.66	292.04	477.00	688.40	903.06	1026.62	1189.31	73.32
All sites excluding skin	10.61	9.76	8.53	12.70	15.68	16.59	25.77	25.76	55.97	82.43	133.64	169.28	274.72	431.98	643.78	817.46	942.62	1084.78	67.04

Appendix Table 13. Age-specific incidence rates in Mazandaran province, female (corrected)

Sites	Age-specific incidence rates (per 100,000 person-years)																		Crude rate (/100,000)
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	
Lip	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.30	0.76	0.00	1.26	2.52	0.85	2.08	2.32	2.83	3.18	0.25
Tongue	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.76	1.09	0.63	0.00	1.70	6.23	4.63	7.01	7.18	0.28
Mouth	0.00	0.00	0.00	0.13	0.00	0.18	0.21	0.00	0.30	0.00	2.18	0.00	0.63	3.39	4.15	6.95	7.16	8.70	0.32
Salivary glands	0.00	0.00	0.00	0.13	0.00	0.37	0.21	0.47	0.30	0.38	1.64	0.00	0.63	0.85	0.00	0.00	0.00	0.00	0.25
Tonsil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	0.00	1.34	0.83	0.03
Other oropharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nasopharynx	0.00	0.00	0.00	0.00	0.34	0.37	0.21	0.94	0.59	0.38	1.09	0.00	2.52	0.85	2.08	0.00	1.34	0.83	0.37
Hypopharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.73	0.63	0.63	3.39	3.11	2.32	3.50	3.59	0.23
Pharynx unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Esophagus	0.18	0.00	0.00	0.26	0.00	0.18	0.83	1.17	6.23	7.98	19.10	27.68	51.64	55.14	73.70	78.79	98.38	109.19	6.68
Stomach	0.37	0.12	0.21	0.39	0.51	0.18	2.07	1.64	2.97	6.08	14.73	17.61	35.27	43.26	46.71	53.30	64.52	72.62	5.42
Small intestine	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.59	0.00	1.64	0.00	1.26	2.54	1.04	2.32	2.16	2.76	0.20
Colon	0.37	0.00	0.00	0.26	0.34	0.37	1.86	4.68	5.05	6.08	10.91	11.32	8.82	11.88	16.61	13.90	19.68	20.70	2.65
Rectum	0.00	0.00	0.00	0.00	0.34	0.37	0.83	0.47	2.08	2.28	4.36	6.29	5.04	2.54	6.23	11.59	11.49	14.22	1.15
Anus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.63	0.63	0.00	0.00	0.00	0.00	0.00	0.05
Liver	0.18	0.12	0.10	0.00	0.17	0.18	0.00	0.00	0.30	0.00	1.09	0.00	1.26	2.54	5.19	2.32	4.84	4.41	0.38
Gallbladder	0.18	0.00	0.10	0.13	0.00	0.37	0.21	0.00	0.30	0.38	0.00	0.00	6.93	3.39	5.19	2.32	4.84	4.41	0.51
Pancreas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.00	0.00	2.73	0.63	1.26	4.24	3.11	9.27	7.99	10.64	0.58
Nose, sinuses	0.00	0.00	0.10	0.00	0.00	0.18	0.00	0.00	0.00	0.38	0.00	0.00	1.89	0.00	1.04	0.00	0.67	0.41	0.12
Larynx	0.18	0.00	0.00	0.00	0.17	0.00	0.00	0.47	0.30	0.38	0.55	1.26	3.15	1.70	4.15	0.00	2.68	1.65	0.35
Lung	0.00	0.00	0.21	0.13	0.17	0.00	0.00	0.70	0.89	1.14	1.09	1.89	3.15	5.94	9.34	13.90	15.00	17.81	0.81
Other thoracic organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.26	0.00	1.70	0.00	0.00	0.00	0.00	0.08
Bone	0.18	0.12	0.62	0.13	0.68	0.18	0.21	0.70	0.30	0.38	1.09	0.00	0.00	1.70	2.08	6.95	5.82	7.87	0.46
Melanoma of skin	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.89	0.00	0.00	1.26	0.63	0.85	2.08	6.95	5.82	7.87	0.32
Other skin	0.00	0.12	0.10	0.13	0.34	0.73	0.83	1.87	6.53	10.64	19.64	12.58	17.63	23.75	30.10	69.52	64.27	82.46	4.29
Mesothelioma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.00	0.00	0.00	0.02
Kaposi sarcoma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Connective & soft tissue	0.18	0.12	0.00	0.26	0.17	0.37	0.41	0.23	0.89	0.38	3.27	0.63	0.00	3.39	0.00	2.32	1.49	2.35	0.43
Breast	0.55	0.12	0.10	0.26	0.85	4.59	12.01	21.53	37.40	39.12	36.01	31.45	30.23	22.90	17.65	20.86	24.84	28.16	10.57
Vulva	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	1.26	1.26	0.00	0.00	0.00	0.00	0.00	0.08
Vagina	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.38	0.00	1.26	0.00	0.85	0.00	0.00	0.00	0.00	0.12
Cervix uteri	0.18	0.00	0.00	0.00	0.00	0.00	0.21	2.81	2.97	1.52	8.18	9.44	7.56	6.79	4.15	18.54	14.64	20.45	1.47
Corpus uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.47	0.89	0.38	2.73	1.26	3.78	9.33	0.00	2.32	1.49	2.35	0.58
Uterus unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.47	0.89	0.76	1.64	1.89	3.15	3.39	1.04	2.32	2.16	2.76	0.55
Ovary	0.00	0.12	0.10	1.45	0.17	0.73	1.24	2.11	2.37	4.56	3.82	1.26	5.04	4.24	2.08	6.95	5.82	7.87	1.35
Other female genitalia	0.00	0.00	0.00	0.00	0.17	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Placenta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kidney	1.11	0.74	0.00	0.13	0.17	0.18	0.00	0.70	0.59	0.76	1.64	0.63	1.89	0.00	0.00	6.95	4.48	7.05	0.52
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ureter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bladder	0.00	0.00	0.00	0.26	0.17	0.18	0.00	0.00	0.59	0.76	2.18	3.15	3.15	5.09	9.34	6.95	10.51	10.76	0.78
Other urinary organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eye	0.37	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.63	0.00	0.00	0.00	2.32	1.49	2.35	0.11
Brain, nervous system	0.55	0.98	0.72	0.79	1.02	1.29	1.45	1.87	1.48	3.04	2.73	4.40	6.30	1.70	3.11	4.63	5.00	5.94	1.52
Thyroid	0.00	0.00	0.21	0.26	0.51	1.47	1.45	1.40	3.56	2.28	1.09	1.89	2.52	2.54	3.11	2.32	3.50	3.59	1.00
Adrenal gland	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Other endocrine	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.55	1.26	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Hodgkin disease	0.00	0.12	0.41	1.18	0.51	0.55	1.04	1.17	0.59	0.38	2.18	1.26	1.89	0.85	1.04	0.00	0.67	0.41	0.70
Non-Hodgkin lymphoma	0.18	0.86	0.31	0.66	0.68	0.73	1.45	1.40	1.48	3.04	5.46	3.77	4.41	6.79	8.30	4.63	8.35	8.00	1.56
Immunoproliferative	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple myeloma	0.00	0.00	0.10	0.00	0.17	0.00	0.00	0.23	0.59	0.38	1.64	0.63	5.04	3.39	4.15	2.32	4.17	4.00	0.46
Lymphoid leukemia	0.18	0.00	0.10	0.00	0.00	0.00	0.00	0.47	0.30	0.00	0.00	0.63	1.89	0.85	0.00	4.63	2.99	4.70	0.21
Myeloid leukemia	0.18	0.00	0.31	0.26	0.00	0.37	0.00	0.00	0.30	0.38	1.64	0.63	1.26	0.85	0.00	2.32	1.49	2.35	0.32
Leukemia unspecified	1.85	1.97	1.34	1.18	0.68	0.18	0.62	0.94	2.08	0.76	3.82	2.52	1.26	4.24	5.19	13.90	12.32	16.16	1.69
Other and unspecified	0.92	0.98	0.62	0.13	0.85	1.29	1.66	0.70	2.08	2.66	3.82	4.40	8.82	11.03	10.38	13.90	15.67	18.23	2.07
All sites	8.13	6.77	5.87	8.68	9.21	15.98	31.07	50.55	87.28	99.89	168.59	161.04	235.55	260.42	295.86	405.56	452.47	528.83	52.09
All sites excluding skin	8.13	6.64	5.77	8.55	8.87	15.25	30.24	48.67	80.74	89.26	148.95	148.46	217.91	236.67	265.75	336.04	388.20	446.37	47.79

Golestan

Appendix Table 14. Age-specific incidence rates in Golestan, male (corrected)

Sites	Age-specific incidence rates (per 100,000 person-years)																		Crude rate (/100,000)
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	
Lip	0.00	0.00	0.00	0.24	0.36	0.00	0.44	0.00	1.31	0.00	3.63	1.40	4.96	4.92	17.31	11.70	18.71	18.74	0.82
Tongue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40	0.00	1.64	0.00	0.00	0.00	0.00	0.06
Mouth	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.93	0.00	0.00	0.00	0.00	2.16	0.00	1.40	0.86	0.11
Salivary glands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tonsil	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00	5.85	3.77	5.93	0.08
Other oropharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nasopharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.28	0.00	0.00	0.00	0.00	0.06
Hypopharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Pharynx unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.31	0.00	0.00	1.40	0.00	8.20	6.49	0.00	4.19	2.58	0.31
Esophagus	0.00	0.00	0.00	0.00	0.00	1.18	2.61	3.87	16.43	18.60	58.12	54.44	95.49	108.29	179.61	210.53	251.67	284.86	12.50
Stomach	0.72	0.18	0.00	0.49	0.72	0.79	1.31	1.45	7.23	10.23	24.22	37.69	80.61	95.16	162.30	152.05	202.78	218.69	9.52
Small intestine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.21	0.00	0.00	0.00	2.16	0.00	1.40	0.86	0.08
Colon	0.00	0.00	0.00	0.00	1.07	0.39	1.74	1.93	1.97	1.86	2.42	2.79	7.44	4.92	12.98	35.09	31.01	40.74	1.32
Rectum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.87	1.31	1.86	6.05	4.19	3.72	8.20	6.49	11.70	11.73	14.44	1.01
Anus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.42	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Liver	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.48	1.31	0.00	0.00	5.58	4.96	4.92	8.66	0.00	5.58	3.44	0.53
Gallbladder	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.24	0.00	0.00	5.85	3.77	5.93	0.06
Pancreas	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.66	0.93	2.42	2.79	4.96	3.28	12.98	11.70	15.92	17.02	0.65
Nose, sinuses	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Larynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.66	2.79	2.42	1.40	1.24	3.28	6.49	17.54	15.51	20.37	0.45
Lung	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.97	0.93	2.42	0.00	11.16	3.28	12.98	11.70	15.92	17.02	0.87
Other thoracic organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.64	0.00	0.00	0.00	0.00	0.03
Bone	0.24	0.18	0.18	0.24	0.36	0.79	0.00	0.48	0.66	0.93	0.00	2.79	1.24	1.64	2.16	0.00	1.40	0.86	0.48
Melanoma of skin	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.48	0.00	0.00	0.00	0.00	3.72	0.00	0.00	5.85	3.77	5.93	0.23
Other skin	0.00	0.00	0.18	0.73	0.00	1.57	0.87	3.38	5.26	13.02	13.32	18.15	23.56	26.25	36.79	81.87	76.55	97.64	4.17
Mesothelioma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Kaposi sarcoma	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Connective & soft tissue	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Breast	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.63	0.00	2.42	2.79	2.48	1.64	8.66	5.85	9.36	9.37	0.48
Vulva	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vagina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cervix uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Corpus uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uterus unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ovary	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other female genitalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Placenta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Penis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48	0.00	0.00	0.00	0.00	0.00	0.06
Prostate	0.00	0.00	0.00	0.00	0.72	0.39	0.00	0.00	0.00	0.93	3.63	5.58	9.92	24.61	56.26	116.96	111.74	140.95	2.67
Testis	0.24	0.00	0.00	0.00	0.36	2.36	0.00	0.97	0.66	0.93	1.21	1.40	1.24	0.00	0.00	0.00	0.00	0.00	0.42
Other male genitalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kidney	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.93	1.21	0.00	8.68	6.56	8.66	0.00	5.58	3.44	0.59
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Ureter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bladder	0.00	0.00	0.00	0.00	0.00	1.18	0.87	1.93	2.63	6.51	8.48	8.37	12.40	26.25	25.97	93.57	77.11	105.19	2.56
Other urinary organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eye	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brain, nervous system	0.00	0.00	0.36	0.49	0.72	0.79	2.18	1.45	0.66	0.00	2.42	0.00	2.48	4.92	2.16	0.00	1.40	0.86	0.76
Thyroid	0.00	0.00	0.00	0.24	0.00	0.00	0.00	1.93	0.66	2.79	1.21	0.00	0.00	0.00	2.16	0.00	1.40	0.86	0.34
Adrenal gland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other endocrine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hodgkin disease	0.00	0.36	0.36	0.73	0.36	0.39	0.00	1.45	1.31	0.00	1.21	2.79	0.00	0.00	0.00	5.85	3.77	5.93	0.56
Non-Hodgkin lymphoma	0.24	0.36	0.18	0.97	1.07	1.18	0.44	0.48	4.60	3.72	6.05	5.58	2.48	3.28	19.48	5.85	16.34	13.67	1.49
Immunoproliferative	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple myeloma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93	1.21	1.40	1.24	1.64	0.00	11.70	7.54	11.86	0.25
Lymphoid leukemia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.16	5.85	5.17	6.79	0.06
Myeloid leukemia	0.00	0.00	0.00	0.00	0.36	0.00	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
Leukemia unspecified	1.67	0.71	1.43	0.97	1.07	0.00	1.31	0.97	0.00	0.00	0.00	1.40	1.24	0.00	4.33	5.85	6.56	7.65	1.15
Other and unspecified	0.24	0.36	0.18	0.97	0.72	0.79	1.74	0.97	3.29	2.79	6.05	1.40	12.40	3.28	12.98	35.09	31.01	40.74	1.69
All sites	3.35	2.31	2.87	6.09	8.22	12.99	15.66	27.06	57.18	74.40	154.98	167.49	301.36	351.11	612.42	847.95	942.06	1103.23	46.94
All sites excluding skin	3.35	2.31	2.69	5.36	8.22	11.41	14.79	23.68	51.92	61.38	141.66	149.35	277.80	324.86	575.63	766.08	865.52	1005.59	42.77

Appendix Table 15. Age-specific incidence rates in Golestan, female (corrected)

Sites	Age-specific incidence rates (per 100,000 person-years)																		Crude rate (/100,000)
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	
Lip	0.25	0.00	0.00	0.45	0.00	0.38	0.00	0.99	0.64	0.00	2.31	3.03	10.10	5.81	8.15	6.40	9.39	9.73	0.73
Tongue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.83	2.31	0.00	4.33	1.94	5.43	6.40	7.64	8.65	0.34
Mouth	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.64	0.00	1.15	0.00	1.44	3.87	2.72	12.80	10.01	14.06	0.25
Salivary glands	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Tonsil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other oropharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nasopharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hypopharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00	1.52	0.00	0.00	2.72	0.00	1.75	1.08	0.08
Pharynx unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.64	0.00	1.15	1.52	0.00	3.87	5.43	0.00	3.51	2.16	0.22
Esophagus	0.00	0.00	0.00	0.00	0.30	1.13	0.85	2.97	12.82	18.23	32.29	56.11	77.95	75.52	89.67	108.83	128.05	146.00	8.21
Stomach	0.00	0.19	0.00	0.00	0.00	0.00	2.14	1.98	2.56	0.83	5.77	10.61	25.98	25.17	59.78	32.01	59.21	56.22	2.63
Small intestine	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.72	0.00	1.75	1.08	0.06
Colon	0.00	0.00	0.00	0.00	0.30	0.38	0.85	0.99	3.20	6.63	2.31	12.13	8.66	17.43	16.30	6.40	14.65	12.97	1.56
Rectum	0.00	0.00	0.00	0.00	0.30	1.13	0.43	2.47	1.28	0.83	3.46	10.61	7.22	3.87	8.15	0.00	5.26	3.24	1.03
Anus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Liver	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.83	1.15	0.00	2.89	0.00	5.43	0.00	3.51	2.16	0.20
Gallbladder	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.49	0.64	0.83	1.15	0.00	1.44	1.94	5.43	12.80	11.77	15.14	0.31
Pancreas	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00	3.87	10.87	0.00	7.01	4.32	0.25
Nose, sinuses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Larynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.94	2.72	0.00	1.75	1.08	0.06
Lung	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.99	0.00	1.66	0.00	1.52	1.44	1.94	2.72	12.80	10.01	14.06	0.34
Other thoracic organs	0.00	0.00	0.00	0.23	0.00	0.00	0.43	0.00	0.64	0.00	0.00	1.52	0.00	0.00	0.00	0.00	0.00	0.00	0.11
Bone	0.00	0.19	0.18	0.91	0.00	0.00	1.28	0.00	0.00	0.00	0.00	0.00	2.89	1.94	0.00	6.40	4.13	6.49	0.39
Melanoma of skin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	1.66	1.15	3.03	0.00	0.00	2.72	12.80	10.01	14.06	0.28
Other skin	0.25	0.19	0.00	0.45	0.30	0.76	0.43	2.47	8.33	9.12	17.30	16.68	11.55	17.43	40.76	44.81	55.20	61.64	2.99
Mesothelioma	0.25	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Kaposi sarcoma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Connective & soft tissue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.52	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Breast	0.00	0.00	0.00	0.00	2.07	4.91	13.25	21.75	28.84	29.83	21.91	9.10	18.77	21.30	29.89	38.41	44.06	50.83	7.12
Vulva	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.72	6.40	5.88	7.57	0.06
Vagina	0.00	0.00	0.00	0.00	0.30	0.00	0.43	0.00	0.00	0.83	1.15	0.00	2.89	5.81	0.00	6.40	4.13	6.49	0.31
Cervix uteri	0.00	0.00	0.00	0.00	0.30	0.76	4.27	2.97	5.77	8.29	9.23	6.07	4.33	13.55	2.72	0.00	1.75	1.08	1.73
Corpus uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00	3.46	1.52	4.33	3.87	5.43	12.80	11.77	15.14	0.45
Uterus unspecified	0.00	0.00	0.00	0.23	0.30	0.00	0.85	0.99	1.92	3.31	5.77	0.00	1.44	3.87	0.00	0.00	0.00	0.00	0.64
Ovary	0.25	0.00	0.18	0.45	0.59	1.89	0.43	5.44	4.49	3.31	5.77	7.58	2.89	3.87	2.72	0.00	1.75	1.08	1.45
Other female genitalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.03	0.00	1.94	0.00	0.00	0.00	0.00	0.08
Placenta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Kidney	0.50	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	2.49	3.46	3.03	0.00	1.94	0.00	0.00	0.00	0.00	0.36
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ureter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.94	0.00	0.00	0.00	0.00	0.03
Bladder	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.99	1.92	0.00	0.00	1.52	4.33	7.75	16.30	12.80	18.78	19.46	0.64
Other urinary organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eye	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brain, nervous system	0.25	0.37	0.55	0.00	0.30	0.38	0.43	1.48	0.00	0.83	1.15	1.52	2.89	0.00	0.00	6.40	4.13	6.49	0.61
Thyroid	0.00	0.00	0.37	0.23	0.00	0.76	0.43	2.97	4.49	3.31	1.15	1.52	1.44	5.81	5.43	0.00	3.51	2.16	0.92
Adrenal gland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other endocrine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hodgkin disease	0.00	0.00	0.18	0.68	0.89	0.76	0.85	0.00	0.64	0.83	1.15	1.52	1.44	0.00	0.00	0.00	0.00	0.00	0.47
Non-Hodgkin lymphoma	0.00	0.37	0.55	0.00	1.18	1.51	2.14	0.49	1.92	0.83	0.00	1.52	7.22	0.00	8.15	6.40	9.39	9.73	0.98
Immunoproliferative	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multiple myeloma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Lymphoid leukemia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.40	4.13	6.49	0.03
Myeloid leukemia	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Leukemia unspecified	1.00	0.94	1.28	0.23	1.18	0.76	0.43	0.99	2.56	2.49	2.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.12
Other and unspecified	0.00	0.00	0.73	1.36	0.89	1.13	0.43	0.49	0.64	4.14	2.31	6.07	7.22	5.81	13.59	19.21	21.15	24.88	1.56
All sites	2.74	2.43	4.20	5.21	9.48	17.38	32.92	53.38	87.15	103.58	130.31	163.77	215.08	243.97	358.70	377.72	475.05	525.58	38.85
All sites excluding skin	2.49	2.25	4.20	4.75	9.18	16.63	32.49	50.91	78.82	94.47	113.01	147.09	203.54	226.55	317.93	332.91	419.85	463.94	35.87

Kerman

Appendix Table 16. Age-specific incidence rates in Kerman, male (corrected)

Sites	Age-specific incidence rates (per 100,000 person-years)																		Crude rate (/100,000)
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	
Lip	0.00	0.00	0.00	0.00	0.23	0.00	0.33	0.35	0.00	1.33	0.00	0.93	2.56	4.35	3.73	8.82	8.09	10.42	0.39
Tongue	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.67	1.84	0.93	2.56	0.00	2.48	0.00	1.60	0.99	0.24
Mouth	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.44	0.00	4.60	0.00	0.00	2.18	1.24	2.94	2.70	3.47	0.31
Salivary glands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40	1.32	1.33	0.00	0.00	3.42	2.18	0.00	0.00	0.00	0.00	0.31
Tonsil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.67	0.00	0.00	0.00	0.00	2.48	0.00	1.60	0.99	0.08
Other oropharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nasopharynx	0.00	0.00	0.00	0.32	0.00	0.29	0.00	0.35	0.88	0.67	0.00	0.00	0.85	0.00	1.24	2.94	2.70	3.47	0.20
Hypopharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	1.84	0.00	0.00	0.00	1.24	2.94	2.70	3.47	0.10
Pharynx unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Esophagus	0.00	0.00	0.00	0.00	0.00	1.43	1.66	0.35	0.88	2.00	5.52	4.65	6.83	7.62	36.03	29.39	42.20	44.12	1.94
Stomach	0.00	0.13	0.00	0.00	0.23	1.15	0.67	3.51	3.07	11.32	15.65	26.94	42.69	55.50	49.70	114.62	106.00	135.97	5.91
Small intestine	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.35	0.00	1.33	0.92	1.86	0.00	1.09	0.00	5.88	3.79	5.96	0.24
Colon	0.00	0.00	0.00	0.16	1.15	0.86	0.33	2.81	2.19	3.33	10.12	1.86	11.10	7.62	8.70	14.70	15.09	18.36	1.59
Rectum	0.00	0.00	0.00	0.00	0.23	0.00	0.33	0.35	2.19	1.33	4.60	9.29	12.81	8.71	13.67	5.88	12.61	11.39	1.34
Anus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93	1.71	2.18	2.48	0.00	1.60	0.99	0.18
Liver	0.18	0.00	0.00	0.00	0.23	0.29	0.00	0.35	3.95	1.33	2.76	1.86	5.98	3.26	14.91	14.70	19.10	20.83	0.96
Gallbladder	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.67	1.84	2.79	3.42	4.35	4.97	8.82	8.89	10.92	0.55
Pancreas	0.00	0.26	0.00	0.00	0.00	0.00	0.33	0.35	1.75	1.33	0.00	2.79	3.42	5.44	7.45	5.88	8.60	8.92	0.73
Nose, sinuses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.94	1.90	2.98	0.02
Larynx	0.00	0.13	0.00	0.00	0.00	0.29	0.33	1.40	6.58	5.33	8.28	8.36	13.66	13.06	16.15	26.45	27.48	33.24	2.08
Lung	0.00	0.00	0.00	0.00	0.23	0.57	0.67	0.35	1.75	2.66	20.25	24.15	40.13	33.73	44.73	64.66	70.56	83.34	4.16
Other thoracic organs	0.00	0.00	0.00	0.00	0.23	0.00	0.67	1.05	1.32	0.00	0.00	3.72	4.27	3.26	1.24	5.88	4.59	6.45	0.53
Bone	0.18	0.00	0.74	2.69	1.61	1.15	0.67	0.35	0.88	1.33	1.84	0.93	0.85	3.26	1.24	2.94	2.70	3.47	1.04
Melanoma of skin	0.18	0.00	0.12	0.00	0.23	0.00	0.33	0.70	0.88	0.00	0.92	1.86	6.83	3.26	6.21	17.63	15.38	20.35	0.75
Other skin	0.18	0.26	0.37	0.00	0.92	1.15	3.33	3.16	12.71	16.65	29.45	25.08	34.15	55.50	83.24	120.50	131.43	155.27	8.07
Mesothelioma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kaposi sarcoma	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85	1.09	0.00	0.00	0.00	0.00	0.06
Connective & soft tissue	0.70	0.26	0.37	0.16	0.00	0.57	1.00	1.05	0.00	1.33	0.92	0.93	2.56	2.18	1.24	0.00	0.80	0.49	0.61
Breast	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.88	1.33	1.84	0.93	3.42	0.00	1.24	2.94	2.70	3.47	0.35
Vulva	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vagina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cervix uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Corpus uteri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uterus unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ovary	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other female genitalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Placenta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kidney	1.58	0.13	0.00	0.00	0.46	0.00	0.00	0.00	0.44	1.33	0.92	2.79	2.56	6.53	3.73	0.00	2.40	1.48	0.65
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Ureter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bladder	0.18	0.00	0.25	0.00	0.46	0.57	2.66	1.05	1.75	6.66	9.20	16.72	23.05	44.62	49.70	67.60	75.66	88.29	4.34
Other urinary organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.09	1.24	0.00	0.80	0.49	0.04
Eye	0.18	0.13	0.00	0.00	0.23	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.85	0.00	4.97	2.94	5.10	4.96	0.24
Brain, nervous system	0.70	1.70	0.99	0.48	0.00	0.86	2.33	2.11	1.75	6.00	7.36	9.29	5.12	6.53	3.73	5.88	6.20	7.44	1.89
Thyroid	0.00	0.00	0.00	0.00	0.23	0.00	1.33	0.00	1.75	0.00	1.84	0.00	2.56	1.09	3.73	11.76	9.99	13.40	0.51
Adrenal gland	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Other endocrine	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00	0.04
Hodgkin disease	0.70	1.31	1.48	1.11	2.77	1.15	1.33	2.46	1.32	4.66	2.76	2.79	2.56	0.00	2.48	2.94	3.50	3.97	1.67
Non-Hodgkin lymphoma	1.23	2.09	1.60	0.79	2.54	0.86	2.33	3.16	5.70	5.33	14.73	15.79	18.78	19.59	22.36	26.45	31.49	35.71	4.09
Immunoproliferative	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Multiple myeloma	0.00	0.13	0.12	0.16	0.00	0.57	0.67	0.70	0.44	2.00	2.76	5.57	9.39	8.71	1.24	17.63	12.18	18.37	1.04
Lymphoid leukemia	0.00	0.13	0.37	0.16	0.00	0.00	0.33	0.35	0.88	4.66	1.84	5.57	7.68	5.44	4.97	14.70	12.69	16.88	1.02
Myeloid leukemia	0.00	0.13	0.00	0.16	0.23	0.57	1.33	0.70	1.75	0.67	2.76	1.86	1.71	1.09	0.00	0.00	0.00	0.00	0.53
Leukemia unspecified	2.99	3.13	3.08	2.22	1.38	2.01	1.66	1.05	2.19	4.66	4.60	0.93	5.98	2.18	3.73	8.82	8.09	10.42	2.91
Other and unspecified	1.58	0.91	1.11	0.95	2.54	1.15	2.99	3.86	2.63	3.33	5.52	6.50	5.12	19.59	24.85	20.57	29.30	30.74	3.04
All sites	10.89	10.97	10.84	9.98	16.84	16.04	30.93	37.56	65.76	97.92	170.27	192.31	302.24	354.75	474.59	684.79	747.90	883.00	57.77
All sites excluding skin	10.71	10.70	10.47	9.98	15.91	14.90	27.60	34.40	53.05	81.27	140.82	167.22	268.09	299.25	391.35	564.29	616.47	727.73	49.70

Appendix Table 17. Age-specific incidence rates in Kerman, female (corrected)

Sites	Age-specific incidence rates (per 100,000 person-years)																		Crude rate (/100,000)
	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	
Lip	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2.60	1.51	3.50	3.23	4.15	0.14
Tongue	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.36	0.00	0.00	0.00	0.00	3.99	0.00	1.51	0.00	0.97	0.60	0.20
Mouth	0.00	0.00	0.25	0.00	0.00	0.28	0.33	0.00	0.00	0.65	1.85	2.02	0.00	6.49	0.00	0.00	0.00	0.00	0.30
Salivary glands	0.00	0.13	0.00	0.00	0.00	0.00	0.33	0.00	0.00	1.29	0.00	2.02	0.00	0.00	3.01	0.00	1.94	1.20	0.20
Tonsil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other oropharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nasopharynx	0.00	0.13	0.13	0.00	0.00	0.28	0.00	0.00	0.46	0.00	2.78	0.00	0.00	1.30	0.00	0.00	0.00	0.00	0.20
Hypopharynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Pharynx unspecified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	1.30	0.00	0.00	0.00	0.00	0.04
Esophagus	0.00	0.13	0.00	0.00	0.00	0.00	0.98	0.72	1.83	5.82	2.78	4.05	4.98	3.89	15.05	7.00	14.23	13.08	1.03
Stomach	0.00	0.13	0.00	0.00	0.00	1.13	1.63	2.15	6.86	6.47	12.95	9.11	21.92	27.26	24.08	28.01	33.61	37.98	2.74
Small intestine	0.00	0.00	0.00	0.00	0.00	0.28	0.33	0.00	0.00	1.29	0.93	2.02	0.00	1.30	1.51	0.00	0.97	0.60	0.22
Colon	0.00	0.00	0.00	0.33	0.94	1.13	0.33	1.07	2.29	3.88	9.25	11.13	10.96	16.88	3.01	10.50	8.72	11.85	1.70
Rectum	0.00	0.00	0.00	0.00	0.00	0.00	0.65	2.15	1.83	2.59	4.63	10.12	14.95	9.09	3.01	7.00	6.46	8.30	1.28
Anus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.93	0.00	2.99	0.00	1.51	0.00	0.97	0.60	0.16
Liver	0.37	0.00	0.00	0.33	0.00	0.28	0.00	0.36	0.92	0.65	3.70	0.00	4.98	1.30	4.52	7.00	7.43	8.90	0.49
Gallbladder	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.92	0.65	3.70	2.02	12.95	9.09	22.58	10.50	21.34	19.63	1.10
Pancreas	0.00	0.00	0.13	0.00	0.00	0.28	0.00	0.36	0.46	0.65	2.78	1.01	1.00	6.49	9.03	10.50	12.60	14.24	0.53
Nose, sinuses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01	0.00	0.00	1.51	0.00	0.97	0.60	0.06
Larynx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.65	4.63	2.02	1.00	2.60	4.52	3.50	5.17	5.35	0.32
Lung	0.00	0.00	0.13	0.17	0.47	0.28	0.33	0.36	2.75	3.88	4.63	3.04	7.97	15.58	19.57	21.01	26.18	29.08	1.40
Other thoracic organs	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.36	0.92	0.65	1.85	1.01	3.99	0.00	1.51	0.00	0.97	0.60	0.26
Bone	0.00	0.27	1.38	1.16	1.89	1.41	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.75
Melanoma of skin	0.00	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.92	0.00	0.93	4.05	3.99	0.00	6.02	3.50	6.14	5.94	0.47
Other skin	0.00	0.13	0.13	0.00	0.24	3.39	3.25	4.30	5.95	19.41	31.46	26.31	38.86	49.33	54.19	101.54	100.46	124.50	6.69
Mesothelioma	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Kaposi sarcoma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Connective & soft tissue	0.00	0.00	0.13	0.50	0.71	1.13	0.33	1.07	1.83	0.65	0.93	1.01	1.00	1.30	3.01	0.00	1.94	1.20	0.59
Breast	0.00	0.00	0.00	0.17	0.94	4.81	11.38	17.18	36.61	40.77	66.61	28.33	29.90	40.24	42.15	49.02	58.81	66.46	9.90
Vulva	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	3.01	0.00	1.94	1.20	0.12
Vagina	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.01	0.00	1.94	1.20	0.08
Cervix uteri	0.00	0.00	0.00	0.00	0.24	0.00	1.63	3.22	3.20	7.12	17.58	7.08	5.98	6.49	7.53	10.50	11.63	13.64	1.68
Corpus uteri	0.00	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.46	0.65	1.85	2.02	2.99	6.49	0.00	0.00	0.00	0.00	0.41
Uterus unspecified	0.00	0.00	0.00	0.00	0.24	0.85	0.00	0.36	0.00	0.65	3.70	2.02	1.99	1.30	1.51	0.00	0.97	0.60	0.37
Ovary	0.00	0.00	0.50	0.50	0.94	0.85	1.63	1.43	1.37	1.29	3.70	4.05	7.97	5.19	9.03	7.00	10.34	10.69	1.32
Other female genitalia	0.00	0.00	0.00	0.00	0.47	0.28	0.00	0.00	0.46	0.00	0.93	0.00	1.99	2.60	1.51	0.00	0.97	0.60	0.20
Placenta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kidney	1.10	0.13	0.13	0.17	0.00	0.00	0.33	0.00	0.46	0.65	0.00	1.01	1.00	3.89	1.51	0.00	0.97	0.60	0.41
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ureter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bladder	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.72	0.46	1.29	5.55	4.05	8.97	5.19	4.52	14.01	11.95	16.00	0.99
Other urinary organs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eye	0.37	0.13	0.00	0.00	0.00	0.28	0.33	0.36	0.00	0.00	1.85	0.00	1.00	1.30	1.51	10.50	7.75	11.25	0.28
Brain, nervous system	0.37	0.94	0.13	1.16	1.18	0.57	1.95	1.79	2.75	4.53	4.63	5.06	5.98	3.89	6.02	0.00	3.88	2.39	1.46
Thyroid	0.00	0.00	0.38	0.00	1.18	1.41	2.60	2.15	4.58	5.82	7.40	2.02	2.99	7.79	6.02	10.50	10.66	13.04	1.60
Adrenal gland	0.00	0.00	0.00	0.00	0.24	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Other endocrine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	0.00	0.00	0.00	0.00	0.04
Hodgkin disease	0.00	0.27	0.75	3.16	0.94	0.57	1.63	0.00	0.00	0.65	0.00	1.01	2.99	0.00	0.00	0.00	0.00	0.00	0.89
Non-Hodgkin lymphoma	0.00	1.07	0.63	1.16	0.94	1.13	1.95	1.07	2.29	2.59	3.70	3.04	10.96	6.49	19.57	17.51	23.92	25.53	1.85
Immunoproliferative	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.02
Multiple myeloma	0.00	0.00	0.13	0.17	0.00	0.00	0.00	0.00	0.46	0.00	1.85	2.02	9.97	3.89	6.02	3.50	6.14	5.94	0.59
Lymphoid leukemia	0.18	0.00	0.25	0.00	0.00	0.28	0.00	0.00	0.92	2.59	0.93	1.01	3.99	7.79	7.53	0.00	4.85	2.99	0.63
Myeloid leukemia	0.00	0.00	0.00	0.33	0.47	1.41	0.33	0.00	0.46	1.29	0.00	1.01	2.99	0.00	1.51	3.50	3.23	4.15	0.41
Leukemia unspecified	2.39	1.74	1.50	2.66	1.65	0.85	0.65	1.79	1.83	3.88	3.70	4.05	6.98	5.19	10.54	0.00	6.80	4.19	2.21
Other and unspecified	0.18	0.80	0.38	1.00	0.71	0.85	1.30	1.07	2.75	6.47	5.55	13.15	10.96	6.49	12.04	21.01	21.32	26.09	2.05
All sites	5.16	6.17	7.14	13.29	14.38	24.90	35.45	45.46	87.41	130.72	220.20	162.89	259.09	271.32	325.13	360.64	442.38	494.92	48.49
All sites excluding skin	5.16	6.04	7.02	13.29	14.14	21.50	32.20	41.17	81.46	111.31	188.74	136.58	220.23	221.99	270.94	259.10	341.92	370.43	41.80

Incidence rates before any correction for elderly ages or cases of unknown age

Appendix Table 18. Relative frequency, crude incidence rate, age-standardized rate (ASR) and cumulative rate by cancer site and sex (before correction for elderly ages or unknown age cases)

Sites	Male						Female					
	No. of cases	Relative freq. %	Crude rate (per 100,000)	ASR* (per 100,000)	Cumulative rate (percent) 0–64	0–69	No. of cases	Relative freq. %	Crude rate (per 100,000)	ASR (per 100,000)	Cumulative rate (percent) 0–64	0–69
Lip	115	0.84	0.50	0.70	0.04	0.06	53	0.50	0.23	0.34	0.02	0.03
Tongue	50	0.37	0.22	0.31	0.02	0.03	68	0.64	0.30	0.41	0.03	0.03
Mouth	68	0.50	0.29	0.42	0.03	0.03	62	0.58	0.27	0.40	0.02	0.04
Salivary glands	42	0.31	0.18	0.24	0.02	0.02	34	0.32	0.15	0.16	0.01	0.01
Tonsil	13	0.10	0.06	0.08	0.00	0.01	8	0.08	0.03	0.06	0.00	0.01
Other oropharynx	2	0.01	0.01	0.01	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
Nasopharynx	101	0.74	0.44	0.57	0.04	0.05	47	0.44	0.20	0.25	0.02	0.02
Hypopharynx	27	0.20	0.12	0.17	0.01	0.01	29	0.27	0.13	0.20	0.01	0.02
Pharynx unspecified	40	0.29	0.17	0.25	0.01	0.03	28	0.26	0.12	0.19	0.01	0.02
Esophagus	1751	12.83	7.59	10.71	0.55	0.82	1230	11.60	5.35	8.04	0.52	0.72
Stomach	3297	24.15	14.30	19.89	1.05	1.66	1309	12.34	5.70	8.33	0.50	0.74
Small intestine	71	0.52	0.31	0.41	0.02	0.03	40	0.38	0.17	0.25	0.02	0.02
Colon	610	4.47	2.64	3.48	0.22	0.29	594	5.60	2.58	3.62	0.25	0.33
Rectum	346	2.53	1.50	1.99	0.12	0.16	296	2.79	1.29	1.84	0.14	0.16
Anus	39	0.29	0.17	0.24	0.02	0.02	20	0.19	0.09	0.14	0.01	0.01
Liver	199	1.46	0.86	1.14	0.06	0.09	131	1.23	0.57	0.79	0.05	0.07
Gallbladder	96	0.70	0.42	0.63	0.03	0.05	156	1.47	0.68	0.99	0.06	0.08
Pancreas	195	1.43	0.85	1.06	0.05	0.10	126	1.19	0.55	0.75	0.03	0.05
Nose, sinuses	36	0.26	0.16	0.20	0.01	0.02	18	0.17	0.08	0.11	0.01	0.01
Larynx	412	3.02	1.79	2.43	0.15	0.21	66	0.62	0.29	0.42	0.03	0.04
Lung, trachea & bronchus	943	6.91	4.09	5.72	0.29	0.47	224	2.11	0.97	1.39	0.07	0.12
Other thoracic organs	55	0.40	0.24	0.32	0.02	0.03	30	0.28	0.13	0.18	0.02	0.02
Bone	193	1.41	0.84	0.89	0.06	0.07	132	1.24	0.57	0.59	0.04	0.04
Melanoma of skin	90	0.66	0.39	0.52	0.03	0.04	71	0.67	0.31	0.41	0.02	0.03
Other skin	1584	0.00	6.87	9.60	0.52	0.73	1122	0.00	4.88	7.11	0.42	0.56
Mesothelioma	6	0.04	0.03	0.03	0.00	0.00	7	0.07	0.03	0.04	0.00	0.00
Kaposi sarcoma	24	0.18	0.10	0.14	0.01	0.01	7	0.07	0.03	0.05	0.00	0.00
Connective and soft tissue	116	0.85	0.50	0.59	0.04	0.05	95	0.90	0.41	0.46	0.03	0.04
Breast	157	1.15	0.68	0.96	0.07	0.08	2120	19.98	9.22	12.26	0.98	1.10
Vulva	0	0.00	0.00	0.00	0.00	0.00	17	0.16	0.07	0.11	0.01	0.01
Vagina	0	0.00	0.00	0.00	0.00	0.00	39	0.37	0.17	0.23	0.01	0.02
Cervix uteri	0	0.00	0.00	0.00	0.00	0.00	333	3.14	1.45	2.10	0.17	0.20
Corpus uteri	0	0.00	0.00	0.00	0.00	0.00	148	1.40	0.64	0.95	0.07	0.10
Uterus unspecified	0	0.00	0.00	0.00	0.00	0.00	164	1.55	0.71	0.95	0.07	0.09
Ovary	0	0.00	0.00	0.00	0.00	0.00	334	3.15	1.45	1.79	0.14	0.16
Other female genitalia	0	0.00	0.00	0.00	0.00	0.00	21	0.20	0.09	0.12	0.01	0.01
Placenta	0	0.00	0.00	0.00	0.00	0.00	2	0.02	0.01	0.01	0.00	0.00
Penis	13	0.10	0.06	0.10	0.01	0.01	0	0.00	0.00	0.00	0.00	0.00
Prostate	815	5.97	3.53	3.94	0.11	0.22	0	0.00	0.00	0.00	0.00	0.00
Testis	194	1.42	0.84	0.89	0.07	0.07	0	0.00	0.00	0.00	0.00	0.00
Other male genitalia	1	0.01	0.00	0.01	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
Kidney	196	1.44	0.85	1.12	0.07	0.10	113	1.07	0.49	0.64	0.04	0.05
Renal pelvis	2	0.01	0.01	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
Ureter	1	0.01	0.00	0.01	0.00	0.00	1	0.01	0.00	0.01	0.00	0.00
Bladder	1082	7.93	4.69	6.46	0.33	0.51	220	2.07	0.96	1.34	0.08	0.11
Other urinary organs	3	0.02	0.01	0.02	0.00	0.00	3	0.03	0.01	0.02	0.00	0.00
Eye	21	0.15	0.09	0.12	0.00	0.00	32	0.30	0.14	0.18	0.01	0.01
Brain, nervous system	394	2.89	1.71	2.03	0.14	0.17	314	2.96	1.37	1.63	0.13	0.14
Thyroid	114	0.84	0.49	0.57	0.04	0.05	337	3.18	1.47	1.56	0.11	0.13
Adrenal gland	2	0.01	0.01	0.01	0.00	0.00	4	0.04	0.02	0.02	0.00	0.00
Other endocrine	18	0.13	0.08	0.08	0.01	0.01	10	0.09	0.04	0.05	0.00	0.01
Hodgkin disease	243	1.78	1.05	1.11	0.08	0.09	149	1.40	0.65	0.64	0.05	0.05
Non-Hodgkin lymphoma	603	4.42	2.61	3.26	0.21	0.26	290	2.73	1.26	1.51	0.10	0.12
Immunoproliferative	2	0.01	0.01	0.02	0.00	0.00	1	0.01	0.00	0.01	0.00	0.00
Multiple myeloma	168	1.23	0.73	1.01	0.07	0.09	82	0.77	0.36	0.51	0.03	0.05
Lymphoid leukemia	118	0.86	0.51	0.68	0.04	0.06	61	0.58	0.27	0.36	0.02	0.03
Myeloid leukemia	61	0.45	0.26	0.29	0.02	0.02	52	0.49	0.23	0.26	0.02	0.02
Leukemia unspecified	507	3.71	2.20	2.08	0.12	0.14	350	3.30	1.52	1.60	0.10	0.11
Other and unspecified	0	0.00	0.00	0.00	0.00	0.00	530	5.00	2.31	2.77	0.18	0.23
All sites	15236	0.00	66.06	87.52	4.83	6.97	11730	0.00	51.04	69.14	4.68	5.99
All sites excluding skin	13652	100.00	59.19	77.92	4.32	6.24	10608	100.00	46.16	62.03	4.26	5.43

* ASR=Age-standardized rate

Provinces

Appendix Table 19. Age-standardized rate (ASR) by province and sex (before correction for elderly ages or unknown age cases)

Site	ASR (per 100,000) by province and sex												
	All 5 provinces			Ardebil		Kerman		Mazandaran		Gilan		Golestan	
	Both	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Lip	0.54	0.70	0.34	0.00	0.00	0.61	0.26	0.50	0.34	0.83	0.09	1.46	1.24
Tongue	0.36	0.31	0.41	0.47	0.54	0.36	0.23	0.48	0.41	0.06	0.44	0.11	0.61
Mouth	0.42	0.42	0.40	0.30	0.00	0.52	0.51	0.42	0.45	0.45	0.30	0.21	0.48
Salivary glands	0.22	0.24	0.16	0.13	0.27	0.44	0.25	0.27	0.25	0.23	0.13	0.00	0.03
Tonsil	0.08	0.08	0.06	0.13	0.29	0.12	0.00	0.00	0.04	0.06	0.07	0.13	0.00
Other oropharynx	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00
Nasopharynx	0.42	0.57	0.25	0.25	0.13	0.25	0.25	1.12	0.41	0.50	0.25	0.10	0.00
Hypopharynx	0.18	0.17	0.20	0.21	0.17	0.19	0.04	0.18	0.37	0.13	0.15	0.11	0.16
Pharynx unspecified	0.22	0.25	0.19	0.51	0.45	0.04	0.07	0.09	0.10	0.24	0.18	0.51	0.41
Esophagus	9.54	10.71	8.04	10.21	16.10	2.70	1.60	11.56	9.68	8.28	5.10	22.44	15.20
Stomach	14.43	19.89	8.33	31.40	26.52	9.31	4.64	18.17	7.30	20.92	8.04	16.47	4.65
Small intestine	0.34	0.41	0.25	0.13	0.08	0.37	0.36	0.38	0.30	0.60	0.27	0.19	0.08
Colon	3.54	3.48	3.62	3.52	3.73	2.42	2.79	3.27	3.39	4.48	4.81	1.86	2.77
Rectum	1.92	1.99	1.84	0.68	1.28	2.06	2.15	2.09	1.59	2.38	2.11	1.53	1.67
Anus	0.20	0.24	0.14	0.25	0.48	0.26	0.31	0.26	0.07	0.17	0.05	0.18	0.00
Liver	0.98	1.14	0.79	1.14	2.18	1.39	0.80	0.78	0.42	1.33	0.92	0.88	0.36
Gallbladder	0.81	0.63	0.99	0.42	1.75	0.91	1.85	0.84	0.69	0.46	0.70	0.11	0.55
Pancreas	0.92	1.06	0.75	0.51	0.91	1.03	0.90	0.92	0.73	1.28	0.72	1.12	0.38
Nose, sinuses	0.16	0.20	0.11	0.17	0.13	0.03	0.07	0.33	0.17	0.26	0.13	0.03	0.00
Larynx	1.47	2.43	0.42	0.72	0.24	3.17	0.62	3.21	0.47	2.23	0.44	0.84	0.11
Lung, trachea & bronchus	3.66	5.72	1.39	5.09	3.11	6.72	2.31	7.16	0.97	4.68	0.99	1.56	0.55
Other thoracic organs	0.25	0.32	0.18	0.08	0.15	0.78	0.46	0.16	0.10	0.34	0.10	0.05	0.15
Bone	0.75	0.89	0.59	1.57	1.45	1.06	0.60	0.59	0.51	0.86	0.44	0.55	0.43
Melanoma of skin	0.47	0.52	0.41	0.21	0.19	1.00	0.76	0.50	0.33	0.27	0.28	0.43	0.50
Other skin	8.46	9.60	7.11	8.26	9.14	12.06	10.77	8.32	5.95	9.48	6.12	6.91	5.33
Mesothelioma	0.03	0.03	0.04	0.00	0.00	0.00	0.04	0.03	0.03	0.06	0.05	0.03	0.05
Kaposi sarcoma	0.10	0.14	0.05	0.13	0.00	0.08	0.00	0.13	0.00	0.22	0.16	0.09	0.04
Connective and soft tissue	0.53	0.59	0.46	0.38	0.42	0.68	0.66	0.86	0.53	0.49	0.45	0.17	0.06
Breast	6.62	0.96	12.26	0.38	7.61	0.55	15.40	1.15	12.77	1.23	12.03	0.85	10.14
Vulva			0.11		0.14		0.16		0.11		0.03		0.12
Vagina			0.23		0.25		0.09		0.13		0.27		0.51
Cervix uteri			2.10		0.74		2.86		2.06		1.80		2.70
Corpus uteri			0.95		0.40		0.60		0.81		1.58		0.86
Uterus unspecified			0.95		3.59		0.60		0.61		0.73		0.93
Ovary			1.79		1.42		1.65		1.57		2.12		1.98
Other female genitalia			0.12		0.00		0.32		0.03		0.10		0.18
Placenta			0.01		0.05		0.00		0.00		0.00		0.05
Penis		0.10		0.08		0.09		0.08		0.11		0.10	
Prostate		3.94		2.71		2.91		3.99		4.29		5.06	
Testis		0.89		0.72		0.69		0.82		1.38		0.57	
Other male genitalia		0.01		0.00		0.00		0.02		0.00		0.00	
Kidney	0.89	1.12	0.64	1.57	0.00	0.88	0.49	0.78	0.65	1.32	0.89	0.95	0.68
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
Ureter	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.06
Bladder	4.01	6.46	1.34	4.96	2.12	6.22	1.51	5.37	0.98	8.11	1.48	4.48	1.12
Other urinary organs	0.02	0.02	0.02	0.00	0.08	0.06	0.00	0.02	0.00	0.00	0.05	0.00	0.00
Eye	0.15	0.12	0.18	0.08	0.31	0.28	0.43	0.09	0.13	0.07	0.10	0.00	0.00
Brain, nervous system	1.84	2.03	1.63	2.84	2.93	2.46	1.96	2.56	1.68	1.05	1.43	0.86	0.70
Thyroid	1.07	0.57	1.56	0.42	0.98	0.66	2.22	0.45	1.12	0.63	1.91	0.53	1.24
Adrenal gland	0.01	0.01	0.02	0.00	0.00	0.02	0.04	0.00	0.01	0.00	0.02	0.00	0.00
Other endocrine	0.06	0.08	0.05	0.17	0.08	0.05	0.04	0.15	0.10	0.02	0.03	0.00	0.00
Hodgkin disease	0.88	1.11	0.64	0.38	0.46	1.78	0.80	1.34	0.71	0.82	0.55	0.59	0.52
Non-Hodgkin lymphoma	2.40	3.26	1.51	1.78	0.60	5.45	2.50	3.26	1.82	2.34	0.83	2.23	1.36
Immunoproliferative	0.01	0.02	0.01	0.00	0.00	0.05	0.04	0.00	0.00	0.04	0.00	0.00	0.00
Multiple myeloma	0.77	1.01	0.51	0.17	0.13	1.55	0.98	1.15	0.61	1.03	0.42	0.39	0.03
Lymphoid leukemia	0.53	0.68	0.36	0.38	0.37	1.58	0.99	0.71	0.28	0.37	0.15	0.10	0.06
Myeloid leukemia	0.28	0.29	0.26	0.25	0.24	0.67	0.53	0.29	0.38	0.14	0.08	0.08	0.02
Leukemia unspecified	1.87	2.08	1.60	0.59	0.87	2.81	2.52	2.65	1.77	2.07	1.32	1.04	1.10
Other and unspecified	3.41	0.00	2.77	4.79	4.59	3.83	2.97	3.33	2.35	4.59	2.69	2.63	2.38
All sites	81.43	87.52	69.14	89.16	97.67	81.13	72.98	90.86	66.28	90.97	64.09	78.55	62.57
All sites excluding skin	72.96	77.92	62.03	80.90	88.53	69.07	62.21	82.54	60.32	81.49	57.97	71.63	57.24

Appendix Table 20. Age-standardized rate (ASR) by province, male (before correction for elderly ages or unknown age cases)

	ASR (per 100,000)											
Rank	All 5 Provinces		Ardebil		Kerman		Mazandaran		Gilan		Golestan	
1	Stomach	19.89	Stomach	31.40	Other skin	12.06	Stomach	18.17	Stomach	20.92	Esophagus	22.44
2	Esophagus	10.71	Esophagus	10.21	Stomach	9.31	Esophagus	11.56	Other skin	9.48	Stomach	16.47
3	Other skin	9.60	Other skin	8.26	Lung, trachea & bronchus	6.72	Other skin	8.32	Esophagus	8.28	Other skin	6.91
4	Bladder	6.46	Lung	5.09	Bladder	6.22	Lung	7.16	Bladder	8.11	Prostate	5.06
5	Lung, trachea & bronchus	5.72	Bladder	4.96	Non-Hodgkin lymphoma	5.45	Bladder	5.37	Lung	4.68	Bladder	4.48
6	Prostate	3.94	Colon	3.52	Larynx	3.17	Prostate	3.99	Colon	4.48	Non-Hodgkin lymphoma	2.23
7	Colon	3.48	Brain, nervous system	2.84	Prostate	2.91	Colon	3.27	Prostate	4.29	Colon	1.86
8	Non-Hodgkin lymphoma	3.26	Prostate	2.71	Leukemia unspecified	2.81	Non-Hodgkin lymphoma	3.26	Rectum	2.38	Lung	1.56
9	Larynx	2.43	Non-Hodgkin lymphoma	1.78	Esophagus	2.70	Larynx	3.21	Non-Hodgkin lymphoma	2.34	Rectum	1.53
10	Leukemia unspecified	2.08	Bone	1.57	Brain, nervous system	2.46	Leukemia unspecified	2.65	Larynx	2.23	Lip	1.46
11	Brain, nervous system	2.03	Kidney	1.57	Colon	2.42	Brain, nervous system	2.56	Leukemia unspecified	2.07	Pancreas	1.12
12	Rectum	1.99	Liver	1.14	Rectum	2.06	Rectum	2.09	Testis	1.38	Leukemia unspecified	1.04
13	Liver	1.14	Larynx	0.72	Hodgkin disease	1.78	Hodgkin disease	1.34	Liver	1.33	Kidney	0.95
14	Kidney	1.12	Testis	0.72	Lymphoid leukemia	1.58	Multiple myeloma	1.15	Kidney	1.32	Liver	0.88
15	Hodgkin disease	1.11	Rectum	0.68	Multiple myeloma	1.55	Breast	1.15	Pancreas	1.28	Brain, nervous system	0.86
16	Pancreas	1.06	Leukemia unspecified	0.59	Liver	1.39	Nasopharynx	1.12	Breast	1.23	Breast	0.85
17	Multiple myeloma	1.01	Pharynx unspecified	0.51	Bone	1.06	Pancreas	0.92	Brain, nervous system	1.05	Larynx	0.84
18	Breast	0.96	Pancreas	0.51	Pancreas	1.03	Connective & soft tissue	0.86	Multiple myeloma	1.03	Hodgkin disease	0.59
19	Testis	0.89	Tongue	0.47	Melanoma of skin	1.00	Gallbladder	0.84	Bone	0.86	Testis	0.57
20	Bone	0.89	Gallbladder	0.42	Gallbladder	0.91	Testis	0.82	Lip	0.83	Bone	0.55
21	Lip	0.70	Thyroid	0.42	Kidney	0.88	Liver	0.78	Hodgkin disease	0.82	Thyroid	0.53
22	Lymphoid leukemia	0.68	Connective & soft tissue	0.38	Other thoracic organs	0.78	Kidney	0.78	Thyroid	0.63	Pharynx unspecified	0.51
23	Gallbladder	0.63	Breast	0.38	Testis	0.69	Lymphoid leukemia	0.71	Small intestine	0.60	Melanoma of skin	0.43
24	Connective & soft tissue	0.59	Hodgkin disease	0.38	Connective& soft tissue	0.68	Bone	0.59	Nasopharynx	0.50	Multiple myeloma	0.39
25	Thyroid	0.57	Lymphoid leukemia	0.38	Myeloid leukemia	0.67	Melanoma of skin	0.50	Connective & soft tissue	0.49	Mouth	0.21
26	Nasopharynx	0.57	Mouth	0.30	Thyroid	0.66	Lip	0.50	Gallbladder	0.46	Small intestine	0.19
27	Melanoma of skin	0.52	Nasopharynx	0.25	Lip	0.61	Tongue	0.48	Mouth	0.45	Anus	0.18
28	Mouth	0.42	Anus	0.25	Breast	0.55	Thyroid	0.45	Lymphoid leukemia	0.37	Connective& soft tissue	0.17
29	Small intestine	0.41	Myeloid leukemia	0.25	Mouth	0.52	Mouth	0.42	Other thoracic organs	0.34	Tonsil	0.13
30	Other thoracic organs	0.32	Hypopharynx	0.21	Salivary glands	0.44	Small intestine	0.38	Melanoma of skin	0.27	Hypopharynx	0.11
31	Tongue	0.31	Melanoma of skin	0.21	Small intestine	0.37	Nose, sinuses	0.33	Nose, sinuses	0.26	Gallbladder	0.11
32	Myeloid leukemia	0.29	Nose, sinuses	0.17	Tongue	0.36	Myeloid leukemia	0.29	Pharynx unspecified	0.24	Tongue	0.11
33	Pharynx unspecified	0.25	Other endocrine	0.17	Eye	0.28	Salivary glands	0.27	Salivary glands	0.23	Lymphoid leukemia	0.10
34	Salivary glands	0.24	Multiple myeloma	0.17	Anus	0.26	Anus	0.26	Kaposi sarcoma	0.22	Penis	0.10
35	Anus	0.24	Salivary glands	0.13	Nasopharynx	0.25	Hypopharynx	0.18	Anus	0.17	Nasopharynx	0.10
36	Nose, sinuses	0.20	Tonsil	0.13	Hypopharynx	0.19	Other thoracic organs	0.16	Myeloid leukemia	0.14	Kaposi sarcoma	0.09
37	Hypopharynx	0.17	Small intestine	0.13	Tonsil	0.12	Other endocrine	0.15	Hypopharynx	0.13	Myeloid leukemia	0.08
38	Kaposi sarcoma	0.14	Kaposi sarcoma	0.13	Penis	0.09	Kaposi sarcoma	0.13	Penis	0.11	Other thoracic organs	0.05
39	Eye	0.12	Other thoracic organs	0.08	Kaposi sarcoma	0.08	Eye	0.09	Eye	0.07	Mesothelioma	0.03
40	Penis	0.10	Penis	0.08	Other urinary organs	0.06	Pharynx unspecified	0.09	Tongue	0.06	Renal pelvis	0.03
41	Tonsil	0.08	Eye	0.08	Other endocrine	0.05	Penis	0.08	Tonsil	0.06	Nose, sinuses	0.03
42	Other endocrine	0.08	Lip	0.00	Immunoproliferative	0.05	Mesothelioma	0.03	Mesothelioma	0.06	Salivary glands	0.00
43	Mesothelioma	0.03	Other oropharynx	0.00	Pharynx unspecified	0.04	Other male genitalia	0.02	Ureter	0.04	Other oropharynx	0.00
44	Immunoproliferative	0.02	Mesothelioma	0.00	Nose, sinuses	0.03	Other urinary organs	0.02	Immunoproliferative	0.04	Other male genitalia	0.00
45	Other urinary organs	0.02	Other male genitalia	0.00	Adrenal gland	0.02	Other oropharynx	0.01	Other endocrine	0.02	Ureter	0.00
46	Ureter	0.01	Renal pelvis	0.00	Other oropharynx	0.00	Tonsil	0.00	Other oropharynx	0.02	Other urinary organs	0.00
47	Other oropharynx	0.01	Ureter	0.00	Mesothelioma	0.00	Renal pelvis	0.00	Other male genitalia	0.00	Eye	0.00
48	Other male genitalia	0.01	Other urinary organs	0.00	Other male genitalia	0.00	Ureter	0.00	Renal pelvis	0.00	Adrenal gland	0.00
49	Adrenal gland	0.01	Adrenal gland	0.00	Renal pelvis	0.00	Adrenal gland	0.00	Other urinary organs	0.00	Other endocrine	0.00
50	Renal pelvis	0.00	Immunoproliferative	0.00	Ureter	0.00	Immunoproliferative	0.00	Adrenal gland	0.00	Immunoproliferative	0.00
	Other & unspecified	0.00	Other & unspecified	4.79	Other & unspecified	3.83	Other & unspecified	3.33	Other & unspecified	4.59	Other & unspecified	2.63
	All sites	87.52	All sites	89.16	All sites	81.13	All sites	90.86	All sites	90.97	All sites	78.55
	All sites excluding skin	77.92	All sites excluding skin	80.90	All sites excluding skin	69.07	All sites excluding skin	82.54	All sites excluding skin	81.49	All sites excluding skin	71.63

Appendix Table 21. Age-standardized rate (ASR) by province, female (before correction for elderly ages or unknown age cases)

Rank	All 5 Provinces	ASR (per 100,000)	Ardebil		Kerman		Mazandaran		Gilan		Golestan	
1	Breast	12.26	Stomach	26.52	Breast	15.40	Breast	12.77	Breast	12.03	Esophagus	15.20
2	Stomach	8.33	Esophagus	16.10	Other skin	10.77	Esophagus	9.68	Stomach	8.04	Breast	10.14
3	Esophagus	8.04	Other skin	9.14	Stomach	4.64	Stomach	7.30	Other skin	6.12	Other skin	5.33
4	Other skin	7.11	Breast	7.61	Cervix uteri	2.86	Other skin	5.95	Esophagus	5.10	Stomach	4.65
5	Colon	3.62	Colon	3.73	Colon	2.79	Colon	3.39	Colon	4.81	Colon	2.77
6	Cervix uteri	2.10	Uterus unspecified	3.59	Leukemia unspecified	2.52	Cervix uteri	2.06	Ovary	2.12	Cervix uteri	2.70
7	Rectum	1.84	Lung, trachea & bronchus	3.11	Non-Hodgkin lymphoma	2.50	Non-Hodgkin lymphoma	1.82	Rectum	2.11	Ovary	1.98
8	Ovary	1.79	Brain, nervous system	2.93	Lung, trachea & bronchus	2.31	Leukemia unspecified	1.77	Thyroid	1.91	Rectum	1.67
9	Brain, nervous system	1.63	Liver	2.18	Thyroid	2.22	Brain, nervous system	1.68	Cervix uteri	1.80	Non-Hodgkin lymphoma	1.36
10	Leukemia unspecified	1.60	Bladder	2.12	Rectum	2.15	Rectum	1.59	Corpus uteri	1.58	Thyroid	1.24
11	Thyroid	1.56	Gallbladder	1.75	Brain, nervous system	1.96	Ovary	1.57	Bladder	1.48	Lip	1.24
12	Non-Hodgkin lymphoma	1.51	Bone	1.45	Gallbladder	1.85	Thyroid	1.12	Brain, nervous system	1.43	Bladder	1.12
13	Lung, trachea & bronchus	1.39	Ovary	1.42	Ovary	1.65	Bladder	0.98	Leukemia unspecified	1.32	Leukemia unspecified	1.10
14	Bladder	1.34	Rectum	1.28	Esophagus	1.60	Lung	0.97	Lung, trachea & bronchus	0.99	Uterus unspecified	0.93
15	Gallbladder	0.99	Thyroid	0.98	Bladder	1.51	Corpus uteri	0.81	Liver	0.92	Corpus uteri	0.86
16	Corpus uteri	0.95	Pancreas	0.91	Lymphoid leukemia	0.99	Pancreas	0.73	Kidney	0.89	Brain, nervous system	0.70
17	Uterus unspecified	0.95	Leukemia unspecified	0.87	Multiple myeloma	0.98	Hodgkin disease	0.71	Non-Hodgkin lymphoma	0.83	Kidney	0.68
18	Liver	0.79	Cervix uteri	0.74	Pancreas	0.90	Gallbladder	0.69	Uterus unspecified	0.73	Tongue	0.61
19	Pancreas	0.75	Non-Hodgkin lymphoma	0.60	Hodgkin disease	0.80	Kidney	0.65	Pancreas	0.72	Gallbladder	0.55
20	Hodgkin disease	0.64	Tongue	0.54	Liver	0.80	Multiple myeloma	0.61	Gallbladder	0.70	Lung	0.55
21	Kidney	0.64	Anus	0.48	Melanoma of skin	0.76	Uterus unspecified	0.61	Hodgkin disease	0.55	Hodgkin disease	0.52
22	Bone	0.59	Hodgkin disease	0.46	Connective& soft tissue	0.66	Connective& soft tissue	0.53	Connective& soft tissue	0.45	Vagina	0.51
23	Multiple myeloma	0.51	Pharynx unspecified	0.45	Larynx	0.62	Bone	0.51	Bone	0.44	Melanoma of skin	0.50
24	Connective& soft tissue	0.46	Connective& soft tissue	0.42	Uterus unspecified	0.60	Larynx	0.47	Tongue	0.44	Mouth	0.48
25	Larynx	0.42	Corpus uteri	0.40	Bone	0.60	Mouth	0.45	Larynx	0.44	Bone	0.43
26	Melanoma of skin	0.41	Lymphoid leukemia	0.37	Corpus uteri	0.60	Liver	0.42	Multiple myeloma	0.42	Pharynx unspecified	0.41
27	Tongue	0.41	Eye	0.31	Myeloid leukemia	0.53	Tongue	0.41	Mouth	0.30	Pancreas	0.38
28	Mouth	0.40	Tonsil	0.29	Mouth	0.51	Nasopharynx	0.41	Melanoma of skin	0.28	Liver	0.36
29	Lymphoid leukemia	0.36	Salivary glands	0.27	Kidney	0.49	Myeloid leukemia	0.38	Vagina	0.27	Other female genital org.	0.18
30	Lip	0.34	Vagina	0.25	Other thoracic organs	0.46	Hypopharynx	0.37	Small intestine	0.27	Hypopharynx	0.16
31	Myeloid leukemia	0.26	Larynx	0.24	Eye	0.43	Lip	0.34	Nasopharynx	0.25	Other thoracic organs	0.15
32	Small intestine	0.25	Myeloid leukemia	0.24	Small intestine	0.36	Melanoma of skin	0.33	Pharynx unspecified	0.18	Vulva	0.12
33	Nasopharynx	0.25	Melanoma of skin	0.19	Other female genitalia	0.32	Small intestine	0.30	Kaposi sarcoma	0.16	Larynx	0.11
34	Vagina	0.23	Hypopharynx	0.17	Anus	0.31	Lymphoid leukemia	0.28	Lymphoid leukemia	0.15	Small intestine	0.08
35	Hypopharynx	0.20	Other thoracic organs	0.15	Lip	0.26	Salivary glands	0.25	Hypopharynx	0.15	Lymphoid leukemia	0.06
36	Pharynx unspecified	0.19	Vulva	0.14	Nasopharynx	0.25	Nose, sinuses	0.17	Nose, sinuses	0.13	Connective& soft tissue	0.06
37	Eye	0.18	Multiple myeloma	0.13	Salivary glands	0.25	Vagina	0.13	Salivary glands	0.13	Ureter	0.06
38	Other thoracic organs	0.18	Nose, sinuses	0.13	Tongue	0.23	Eye	0.13	Other female genital org.	0.10	Placenta	0.05
39	Salivary glands	0.16	Nasopharynx	0.13	Vulva	0.16	Vulva	0.11	Other thoracic org.	0.10	Mesothelioma	0.05
40	Anus	0.14	Small intestine	0.08	Vagina	0.09	Other thoracic organs	0.10	Eye	0.10	Kaposi sarcoma	0.04
41	Other female genital org.	0.12	Other urinary organs	0.08	Nose, sinuses	0.07	Other endocrine	0.10	Lip	0.09	Salivary glands	0.03
42	Vulva	0.11	Other endocrine	0.08	Pharynx unspecified	0.07	Pharynx unspecified	0.10	Myeloid leukemia	0.08	Multiple myeloma	0.03
43	Nose, sinuses	0.11	Placenta	0.05	Adrenal gland	0.04	Anus	0.07	Tonsil	0.07	Myeloid leukemia	0.02
44	Tonsil	0.06	Lip	0.00	Mesothelioma	0.04	Tonsil	0.04	Mesothelioma	0.05	Tonsil	0.00
45	Other endocrine	0.05	Mouth	0.00	Immunoproliferative	0.04	Other female genitalia	0.03	Other urinary org.	0.05	Other oropharynx	0.00
46	Kaposi sarcoma	0.05	Other oropharynx	0.00	Other endocrine	0.04	Mesothelioma	0.03	Anus	0.05	Nasopharynx	0.00
47	Mesothelioma	0.04	Mesothelioma	0.00	Hypopharynx	0.04	Adrenal gland	0.01	Other endocrine	0.03	Anus	0.00
48	Other urinary organs	0.02	Kaposi sarcoma	0.00	Tonsil	0.00	Other oropharynx	0.00	Vulva	0.03	Nose, sinuses	0.00
49	Adrenal gland	0.02	Other female genitalia	0.00	Other oropharynx	0.00	Kaposi sarcoma	0.00	Adrenal gland	0.02	Renal pelvis	0.00
50	Placenta	0.01	Kidney	0.00	Kaposi sarcoma	0.00	Placenta	0.00	Other oropharynx	0.00	Other urinary organs	0.00
51	Immunoproliferative	0.01	Renal pelvis	0.00	Placenta	0.00	Renal pelvis	0.00	Placenta	0.00	Eye	0.00
52	Ureter	0.01	Ureter	0.00	Renal pelvis	0.00	Ureter	0.00	Renal pelvis	0.00	Adrenal gland	0.00
53	Renal pelvis	0.00	Adrenal gland	0.00	Ureter	0.00	Other urinary organs	0.00	Ureter	0.00	Other endocrine	0.00
54	Other oropharynx	0.00	Immunoproliferative	0.00	Other urinary organs	0.00	Immunoproliferative	0.00	Immunoproliferative	0.00	Immunoproliferative	0.00
	Other& unspecified	2.77	Other& unspecified	4.59	Other& unspecified	2.97	Other& unspecified	2.35	Other& unspecified	2.69	Other& unspecified	2.38
	All sites	69.14	All sites	97.67	All sites	72.98	All sites	66.28	All sites	64.09	All sites	62.57
	All sites excluding skin	62.03	All sites excluding skin	88.53	All sites excluding skin	62.21	All sites excluding skin	60.32	All sites excluding skin	57.97	All sites excluding skin	57.24

Appendix Table 22. Age-standardized rate (ASR) by cancer site, year and sex in Gilan, Mazandaran, Golestan and Kerman but not Ardebil (before correction for elderly ages or unknown age cases)

Site	ASR by year and sex in 4 provinces (Gilan, Mazandaran, Golestan and Kerman)									
	1996		1997		1998		1999		2000	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Lip	0.58	0.52	0.60	0.16	0.35	0.23	0.31	0.29	0.93	0.45
Tongue	0.23	0.35	0.10	0.10	0.08	0.16	0.15	0.24	0.12	0.58
Mouth	0.12	0.27	0.36	0.22	0.25	0.48	0.20	0.20	0.52	0.35
Salivary glands	0.32	0.07	0.14	0.11	0.17	0.05	0.20	0.31	0.13	0.16
Tonsil	0.08	0.00	0.06	0.04	0.06	0.00	0.03	0.03	0.00	0.00
Other oropharynx	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nasopharynx	0.29	0.04	0.23	0.00	0.37	0.30	0.58	0.16	0.45	0.39
Hypopharynx	0.06	0.09	0.07	0.08	0.17	0.14	0.19	0.26	0.14	0.11
Pharynx unspecified	0.13	0.13	0.23	0.07	0.14	0.17	0.22	0.13	0.10	0.08
Esophagus	7.37	5.29	7.30	5.25	6.41	4.20	7.23	5.49	8.48	5.95
Stomach	10.71	3.11	10.68	4.76	11.20	4.52	12.44	5.13	15.00	5.72
Small intestine	0.23	0.12	0.41	0.21	0.27	0.07	0.43	0.28	0.32	0.29
Colon	1.78	1.59	1.89	2.36	2.03	2.85	2.75	3.84	3.46	3.74
Rectum	1.21	1.04	1.23	1.30	1.40	1.75	2.16	1.54	1.98	1.96
Anus	0.07	0.05	0.20	0.17	0.34	0.04	0.10	0.15	0.00	0.08
Liver	0.78	0.41	0.66	0.26	1.19	0.64	1.05	0.56	0.81	0.75
Gallbladder	0.53	0.73	0.37	0.81	0.26	0.84	0.50	0.99	0.59	0.67
Pancreas	0.60	0.24	1.17	0.61	0.87	0.35	0.97	0.68	1.06	0.67
Nose, sinuses	0.04	0.00	0.09	0.03	0.19	0.08	0.11	0.04	0.01	0.06
Larynx	2.14	0.29	1.04	0.23	1.50	0.38	2.13	0.34	2.25	0.33
Lung, trachea & bronchus	2.58	0.60	3.69	1.40	4.24	0.84	3.91	0.99	5.89	1.32
Other thoracic organs	0.09	0.05	0.07	0.20	0.26	0.17	0.27	0.21	0.72	0.09
Bone	0.55	0.44	0.43	0.32	0.66	0.22	0.82	0.45	0.68	0.59
Melanoma of skin	0.41	0.32	0.68	0.19	0.42	0.53	0.30	0.44	0.31	0.49
Other skin	5.16	3.85	5.06	4.16	6.74	4.55	8.08	6.01	8.15	6.24
Mesothelioma	0.02	0.05	0.00	0.04	0.05	0.02	0.00	0.00	0.00	0.11
Kaposi sarcoma	0.04	0.00	0.09	0.00	0.07	0.08	0.21	0.09	0.10	0.09
Connective and soft tissue	0.66	0.28	0.23	0.29	0.15	0.54	0.46	0.07	0.59	0.55
Breast	0.45	7.91	0.56	7.02	0.93	8.25	0.48	12.55	0.31	13.19
Vulva		0.00		0.08		0.08		0.15		0.04
Vagina		0.21		0.11		0.15		0.28		0.25
Cervix uteri		1.26		1.08		1.47		2.40		1.96
Corpus uteri		0.60		0.59		0.58		0.84		0.68
Uterus unspecified		0.33		0.19		0.55		0.79		0.91
Ovary		0.85		0.94		1.25		2.22		1.53
Other female genitalia		0.17		0.12		0.08		0.06		0.10
Placenta		0.00		0.00		0.00		0.00		0.04
Penis	0.03		0.07		0.00		0.11		0.11	
Prostate	2.09		2.33		3.35		3.52		3.98	
Testis	0.44		0.30		0.48		0.97		0.93	
Other male genitalia	0.00		0.00		0.00		0.00		0.03	
Kidney	0.56	0.36	0.56	0.47	1.06	0.62	1.24	0.75	0.91	0.75
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
Ureter	0.00	0.00	0.00	0.00	0.00	0.04	0.06	0.00	0.00	0.00
Bladder	3.62	0.68	3.84	0.90	5.39	1.38	5.37	1.01	6.55	1.32
Other urinary organs	0.00	0.00	0.04	0.00	0.03	0.00	0.00	0.00	0.00	0.00
Eye	0.06	0.04	0.03	0.14	0.12	0.15	0.18	0.25	0.09	0.13
Brain, nervous system	1.35	1.62	1.22	0.85	1.24	1.28	1.70	1.50	1.31	0.96
Thyroid	0.50	1.01	0.37	1.49	0.35	1.15	0.27	1.62	0.65	1.02
Adrenal gland	0.00	0.00	0.00	0.07	0.03	0.02	0.00	0.00	0.00	0.00
Other endocrine	0.15	0.08	0.04	0.00	0.02	0.07	0.02	0.08	0.02	0.02
Hodgkin disease	0.79	0.50	0.90	0.21	1.03	0.45	1.12	0.67	1.02	0.84
Non-Hodgkin lymphoma	2.07	1.12	1.98	0.85	2.23	1.09	3.28	1.59	3.17	1.58
Immunoproliferative	0.05	0.00	0.00	0.04	0.06	0.00	0.00	0.00	0.00	0.00
Multiple myeloma	0.42	0.11	0.81	0.48	1.20	0.37	0.79	0.59	1.48	0.77
Lymphoid leukemia	0.54	0.12	0.99	0.24	0.49	0.58	0.71	0.36	0.37	0.40
Myeloid leukemia	0.22	0.15	0.29	0.29	0.21	0.31	0.32	0.30	0.27	0.17
Leukemia unspecified	1.35	1.27	2.00	1.24	1.83	1.74	2.23	1.38	2.54	1.77
Other and unspecified	2.40	1.90	2.22	2.00	3.11	1.90	2.85	2.07	4.03	2.48
All sites	53.89	40.22	55.64	42.76	63.02	47.74	70.98	60.39	80.59	62.74
All sites excluding skin	48.73	36.37	50.58	38.60	56.27	43.19	62.91	54.38	72.45	56.51

Appendix Table 23. Age-standardized rate (ASR) by site and year in four provinces of Gilan, Mazandaran, Golestan and Kerman, male (before correction for elderly ages or unknown age cases)

	ASR of each cancer site by year									
	1996		1997		1998		1999		2000	
1	Stomach	10.71	Stomach	10.68	Stomach	11.20	Stomach	12.44	Stomach	15.00
2	Esophagus	7.37	Esophagus	7.30	Other skin	6.74	Other skin	8.08	Esophagus	8.48
3	Other skin	5.16	Other skin	5.06	Esophagus	6.41	Esophagus	7.23	Other skin	8.15
4	Bladder	3.62	Bladder	3.84	Bladder	5.39	Bladder	5.37	Bladder	6.55
5	Lung, trachea & bronchus	2.58	Lung, trachea & bronchus	3.69	Lung, trachea & bronchus	4.24	Lung, trachea & bronchus	3.91	Lung, trachea & bronchus	5.89
6	Larynx	2.14	Prostate	2.33	Prostate	3.35	Prostate	3.52	Prostate	3.98
7	Prostate	2.09	Leukemia unspecified	2.00	Non-Hodgkin lymphoma	2.23	Non-Hodgkin lymphoma	3.28	Colon	3.46
8	Non-Hodgkin lymphoma	2.07	Non-Hodgkin lymphoma	1.98	Colon	2.03	Colon	2.75	Non-Hodgkin lymphoma	3.17
9	Colon	1.78	Colon	1.89	Leukemia unspecified	1.83	Leukemia unspecified	2.23	Leukemia unspecified	2.54
10	Brain, nervous system	1.35	Rectum	1.23	Larynx	1.50	Rectum	2.16	Larynx	2.25
11	Leukemia unspecified	1.35	Brain, nervous system	1.22	Rectum	1.40	Larynx	2.13	Rectum	1.98
12	Rectum	1.21	Pancreas	1.17	Brain, nervous system	1.24	Brain, nervous system	1.70	Multiple myeloma	1.48
13	Hodgkin disease	0.79	Larynx	1.04	Multiple myeloma	1.20	Kidney	1.24	Brain, nervous system	1.31
14	Liver	0.78	Lymphoid leukemia	0.99	Liver	1.19	Hodgkin disease	1.12	Pancreas	1.06
15	Connective& soft tissue	0.66	Hodgkin disease	0.90	Kidney	1.06	Liver	1.05	Hodgkin disease	1.02
16	Pancreas	0.60	Multiple myeloma	0.81	Hodgkin disease	1.03	Pancreas	0.97	Testis	0.93
17	Lip	0.58	Melanoma of skin	0.68	Breast	0.93	Testis	0.97	Lip	0.93
18	Kidney	0.56	Liver	0.66	Pancreas	0.87	Bone	0.82	Kidney	0.91
19	Bone	0.55	Lip	0.60	Bone	0.66	Multiple myeloma	0.79	Liver	0.81
20	Lymphoid leukemia	0.54	Kidney	0.56	Lymphoid leukemia	0.49	Lymphoid leukemia	0.71	Other thoracic organs	0.72
21	Gallbladder	0.53	Breast	0.56	Testis	0.48	Nasopharynx	0.58	Bone	0.68
22	Thyroid	0.50	Bone	0.43	Melanoma of skin	0.42	Gallbladder	0.50	Thyroid	0.65
23	Breast	0.45	Small intestine	0.41	Nasopharynx	0.37	Breast	0.48	Gallbladder	0.59
24	Testis	0.44	Gallbladder	0.37	Lip	0.35	Connective& soft tissue	0.46	Connective& soft tissue	0.59
25	Multiple myeloma	0.42	Thyroid	0.37	Thyroid	0.35	Small intestine	0.43	Mouth	0.52
26	Melanoma of skin	0.41	Mouth	0.36	Anus	0.34	Myeloid leukemia	0.32	Nasopharynx	0.45
27	Salivary glands	0.32	Testis	0.30	Small intestine	0.27	Lip	0.31	Lymphoid leukemia	0.37
28	Nasopharynx	0.29	Myeloid leukemia	0.29	Other thoracic organs	0.26	Melanoma of skin	0.30	Small intestine	0.32
29	Small intestine	0.23	Pharynx unspecified	0.23	Gallbladder	0.26	Other thoracic organs	0.27	Breast	0.31
30	Tongue	0.23	Connective& soft tissue	0.23	Mouth	0.25	Thyroid	0.27	Melanoma of skin	0.31
31	Myeloid leukemia	0.22	Nasopharynx	0.23	Myeloid leukemia	0.21	Pharynx unspecified	0.22	Myeloid leukemia	0.27
32	Other endocrine	0.15	Anus	0.20	Nose, sinuses	0.19	Kaposi sarcoma	0.21	Hypopharynx	0.14
33	Pharynx unspecified	0.13	Salivary glands	0.14	Salivary glands	0.17	Mouth	0.20	Salivary glands	0.13
34	Mouth	0.12	Tongue	0.10	Hypopharynx	0.17	Salivary glands	0.20	Tongue	0.12
35	Other thoracic organs	0.09	Kaposi sarcoma	0.09	Connective& soft tissue	0.15	Hypopharynx	0.19	Penis	0.11
36	Tonsil	0.08	Nose, sinuses	0.09	Pharynx unspecified	0.14	Eye	0.18	Kaposi sarcoma	0.10
37	Anus	0.07	Other thoracic organs	0.07	Eye	0.12	Tongue	0.15	Pharynx unspecified	0.10
38	Hypopharynx	0.06	Penis	0.07	Tongue	0.08	Nose, sinuses	0.11	Eye	0.09
39	Eye	0.06	Hypopharynx	0.07	Kaposi sarcoma	0.07	Penis	0.11	Other male genitalia	0.03
40	Immunoproliferative	0.05	Tonsil	0.06	Tonsil	0.06	Anus	0.10	Other endocrine	0.02
41	Nose, sinuses	0.04	Other endocrine	0.04	Immunoproliferative	0.06	Ureter	0.06	Renal pelvis	0.02
42	Kaposi sarcoma	0.04	Other urinary organs	0.04	Mesothelioma	0.05	Tonsil	0.03	Nose, sinuses	0.01
43	Penis	0.03	Eye	0.03	Other urinary organs	0.03	Other endocrine	0.02	Tonsil	0.00
44	Other oropharynx	0.03	Other oropharynx	0.00	Adrenal gland	0.03	Other oropharynx	0.00	Other oropharynx	0.00
45	Mesothelioma	0.02	Mesothelioma	0.00	Other endocrine	0.02	Mesothelioma	0.00	Anus	0.00
46	Other male genitalia	0.00	Other male genitalia	0.00	Other oropharynx	0.00	Other male genitalia	0.00	Mesothelioma	0.00
47	Renal pelvis	0.00	Renal pelvis	0.00	Penis	0.00	Renal pelvis	0.00	Ureter	0.00
48	Ureter	0.00	Ureter	0.00	Other male genitalia	0.00	Other urinary organs	0.00	Other urinary organs	0.00
49	Other urinary organs	0.00	Adrenal gland	0.00	Renal pelvis	0.00	Adrenal gland	0.00	Adrenal gland	0.00
50	Adrenal gland	0.00	Immunoproliferative	0.00	Ureter	0.00	Immunoproliferative	0.00	Immunoproliferative	0.00
	Other& unspecified	2.40	Other& unspecified	2.22	Other& unspecified	3.11	Other& unspecified	2.85	Other& unspecified	4.03
	All sites	53.89	All sites	55.64	All sites	63.02	All sites	70.98	All sites	80.59
	All sites excluding skin	48.73	All sites excluding skin	50.58	All sites excluding skin	56.27	All sites excluding skin	62.91	All sites excluding skin	72.45

Appendix Table 24. Age-standardized rate (ASR) by site and year in four provinces of Gilan, Mazandaran, Golestan and Kerman, female (before correction for elderly ages or unknown age cases)

	ASR of each cancer site by year									
	1996		1997		1998		1999		2000	
1	Breast	7.91	Breast	7.02	Breast	8.25	Breast	12.55	Breast	13.19
2	Esophagus	5.29	Esophagus	5.25	Other skin	4.55	Other skin	6.01	Other skin	6.24
3	Other skin	3.85	Stomach	4.76	Stomach	4.52	Esophagus	5.49	Esophagus	5.95
4	Stomach	3.11	Other skin	4.16	Esophagus	4.20	Stomach	5.13	Stomach	5.72
5	Brain, nervous system	1.62	Colon	2.36	Colon	2.85	Colon	3.84	Colon	3.74
6	Colon	1.59	Thyroid	1.49	Rectum	1.75	Cervix uteri	2.40	Cervix uteri	1.96
7	Leukemia unspecified	1.27	Lung, trachea & bronchus	1.40	Leukemia unspecified	1.74	Ovary	2.22	Rectum	1.96
8	Cervix uteri	1.26	Rectum	1.30	Cervix uteri	1.47	Thyroid	1.62	Leukemia unspecified	1.77
9	Non-Hodgkin lymphoma	1.12	Leukemia unspecified	1.24	Bladder	1.38	Non-Hodgkin lymphoma	1.59	Non-Hodgkin lymphoma	1.58
10	Rectum	1.04	Cervix uteri	1.08	Brain, nervous system	1.28	Rectum	1.54	Ovary	1.53
11	Thyroid	1.01	Ovary	0.94	Ovary	1.25	Brain, nervous system	1.50	Lung, trachea & bronchus	1.32
12	Ovary	0.85	Bladder	0.90	Thyroid	1.15	Leukemia unspecified	1.38	Bladder	1.32
13	Gallbladder	0.73	Non-Hodgkin lymphoma	0.85	Non-Hodgkin lymphoma	1.09	Bladder	1.01	Thyroid	1.02
14	Bladder	0.68	Brain, nervous system	0.85	Gallbladder	0.84	Gallbladder	0.99	Brain, nervous system	0.96
15	Lung, trachea & bronchus	0.60	Gallbladder	0.81	Lung, trachea & bronchus	0.84	Lung, trachea & bronchus	0.99	Uterus unspecified	0.91
16	Corpus uteri	0.60	Pancreas	0.61	Liver	0.64	Corpus uteri	0.84	Hodgkin disease	0.84
17	Lip	0.52	Corpus uteri	0.59	Kidney	0.62	Uterus unspecified	0.79	Multiple myeloma	0.77
18	Hodgkin disease	0.50	Multiple myeloma	0.48	Corpus uteri	0.58	Kidney	0.75	Kidney	0.75
19	Bone	0.44	Kidney	0.47	Lymphoid leukemia	0.58	Pancreas	0.68	Liver	0.75
20	Liver	0.41	Bone	0.32	Uterus unspecified	0.55	Hodgkin disease	0.67	Corpus uteri	0.68
21	Kidney	0.36	Myeloid leukemia	0.29	Connective& soft tissue	0.54	Multiple myeloma	0.59	Gallbladder	0.67
22	Tongue	0.35	Connective& soft tissue	0.29	Melanoma of skin	0.53	Liver	0.56	Pancreas	0.67
23	Uterus unspecified	0.33	Liver	0.26	Mouth	0.48	Bone	0.45	Bone	0.59
24	Melanoma of skin	0.32	Lymphoid leukemia	0.24	Hodgkin disease	0.45	Melanoma of skin	0.44	Tongue	0.58
25	Larynx	0.29	Larynx	0.23	Larynx	0.38	Lymphoid leukemia	0.36	Connective& soft tissue	0.55
26	Connective& soft tissue	0.28	Mouth	0.22	Multiple myeloma	0.37	Larynx	0.34	Melanoma of skin	0.49
27	Mouth	0.27	Small intestine	0.21	Pancreas	0.35	Salivary glands	0.31	Lip	0.45
28	Pancreas	0.24	Hodgkin disease	0.21	Myeloid leukemia	0.31	Myeloid leukemia	0.30	Lymphoid leukemia	0.40
29	Vagina	0.21	Other thoracic organs	0.20	Nasopharynx	0.30	Lip	0.29	Nasopharynx	0.39
30	Other female genitalia	0.17	Uterus unspecified	0.19	Lip	0.23	Vagina	0.28	Mouth	0.35
31	Myeloid leukemia	0.15	Melanoma of skin	0.19	Bone	0.22	Small intestine	0.28	Larynx	0.33
32	Pharynx unspecified	0.13	Anus	0.17	Other thoracic organs	0.17	Hypopharynx	0.26	Small intestine	0.29
33	Lymphoid leukemia	0.12	Lip	0.16	Pharynx unspecified	0.17	Eye	0.25	Vagina	0.25
34	Small intestine	0.12	Eye	0.14	Tongue	0.16	Tongue	0.24	Myeloid leukemia	0.17
35	Multiple myeloma	0.11	Other female genitalia	0.12	Vagina	0.15	Other thoracic organs	0.21	Salivary glands	0.16
36	Hypopharynx	0.09	Salivary glands	0.11	Eye	0.15	Mouth	0.20	Eye	0.13
37	Other endocrine	0.08	Vagina	0.11	Hypopharynx	0.14	Nasopharynx	0.16	Hypopharynx	0.11
38	Salivary glands	0.07	Tongue	0.10	Vulva	0.08	Vulva	0.15	Mesothelioma	0.11
39	Anus	0.05	Hypopharynx	0.08	Other female genitalia	0.08	Anus	0.15	Other female genitalia	0.10
40	Other thoracic organs	0.05	Vulva	0.08	Nose, sinuses	0.08	Pharynx unspecified	0.13	Other thoracic organs	0.09
41	Mesothelioma	0.05	Pharynx unspecified	0.07	Kaposi sarcoma	0.08	Kaposi sarcoma	0.09	Kaposi sarcoma	0.09
42	Nasopharynx	0.04	Adrenal gland	0.07	Other endocrine	0.07	Other endocrine	0.08	Anus	0.08
43	Eye	0.04	Mesothelioma	0.04	Small intestine	0.07	Connective& soft tissue	0.07	Pharynx unspecified	0.08
44	Tonsil	0.00	Immunoproliferative	0.04	Salivary glands	0.05	Other female genitalia	0.06	Nose, sinuses	0.06
45	Other oropharynx	0.00	Tonsil	0.04	Anus	0.04	Nose, sinuses	0.04	Vulva	0.04
46	Nose, sinuses	0.00	Nose, sinuses	0.03	Ureter	0.04	Tonsil	0.03	Placenta	0.04
47	Kaposi sarcoma	0.00	Other oropharynx	0.00	Mesothelioma	0.02	Other oropharynx	0.00	Other endocrine	0.02
48	Vulva	0.00	Nasopharynx	0.00	Adrenal gland	0.02	Mesothelioma	0.00	Tonsil	0.00
49	Placenta	0.00	Kaposi sarcoma	0.00	Tonsil	0.00	Placenta	0.00	Other oropharynx	0.00
50	Renal pelvis	0.00	Placenta	0.00	Other oropharynx	0.00	Renal pelvis	0.00	Renal pelvis	0.00
51	Ureter	0.00	Renal pelvis	0.00	Placenta	0.00	Ureter	0.00	Ureter	0.00
52	Other urinary organs	0.00	Ureter	0.00	Renal pelvis	0.00	Other urinary organs	0.00	Other urinary organs	0.00
53	Adrenal gland	0.00	Other urinary organs	0.00	Other urinary organs	0.00	Adrenal gland	0.00	Adrenal gland	0.00
54	Immunoproliferative	0.00	Other endocrine	0.00	Immunoproliferative	0.00	Immunoproliferative	0.00	Immunoproliferative	0.00
	Other& unspecified	1.90	Other& unspecified	2.00	Other& unspecified	1.90	Other& unspecified	2.07	Other& unspecified	2.48
	All sites	40.22	All sites	42.76	All sites	47.74	All sites	60.39	All sites	62.74
	All sites excluding skin	36.37	All sites excluding skin	38.60	All sites excluding skin	43.19	All sites excluding skin	54.38	All sites excluding skin	56.51

Incidence rates after correction for elderly ages or cases of unknown age

Appendix Table 25. Age-standardized rate (ASR) by province and sex (after corrections)

Site	ASR (per 100,000)												
	All 5 provinces			Ardebil		Kerman		Mazandaran		Gilan		Golestan	
	Both	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Lip	0.60	0.80	0.37	0.00	0.00	0.66	0.22	0.80	0.37	0.87	0.11	1.39	1.39
Tongue	0.41	0.33	0.49	0.74	1.21	0.41	0.34	0.51	0.43	0.06	0.42	0.11	0.75
Mouth	0.46	0.43	0.46	0.56	0.00	0.49	0.47	0.43	0.55	0.50	0.37	0.14	0.60
Salivary glands	0.24	0.24	0.20	0.19	0.27	0.47	0.33	0.28	0.31	0.19	0.15	0.00	0.03
Tonsil	0.09	0.09	0.07	0.21	0.40	0.13	0.00	0.00	0.05	0.07	0.07	0.18	0.00
Other oropharynx	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00
Nasopharynx	0.47	0.64	0.28	0.36	0.13	0.28	0.32	1.29	0.48	0.53	0.25	0.10	0.00
Hypopharynx	0.20	0.18	0.22	0.34	0.17	0.22	0.04	0.21	0.41	0.10	0.17	0.11	0.18
Pharynx unspecified	0.24	0.26	0.20	0.91	0.45	0.00	0.07	0.13	0.12	0.25	0.18	0.54	0.44
Esophagus	10.77	12.13	8.89	18.34	16.68	3.13	1.84	13.69	10.78	9.76	5.85	23.60	16.91
Stomach	16.46	22.54	9.33	54.82	28.48	10.33	5.07	20.81	8.16	24.93	9.58	17.78	5.48
Small intestine	0.39	0.48	0.27	0.15	0.08	0.41	0.36	0.47	0.33	0.77	0.29	0.12	0.09
Colon	4.00	3.87	4.03	5.96	3.94	2.56	2.98	3.82	3.88	4.83	5.50	2.48	2.91
Rectum	2.18	2.33	1.98	0.99	1.47	2.26	2.29	2.55	1.60	2.85	2.37	1.82	1.77
Anus	0.19	0.24	0.13	0.40	0.48	0.26	0.24	0.29	0.07	0.14	0.05	0.18	0.00
Liver	1.15	1.36	0.89	1.85	2.34	1.66	0.88	1.07	0.56	1.49	1.04	0.93	0.39
Gallbladder	0.90	0.62	1.15	0.63	2.32	0.88	2.05	0.93	0.72	0.32	0.90	0.16	0.69
Pancreas	1.14	1.32	0.88	0.87	0.93	1.04	0.96	1.35	0.78	1.73	1.03	1.25	0.49
Nose, sinuses	0.17	0.22	0.12	0.25	0.24	0.05	0.12	0.30	0.15	0.32	0.16	0.03	0.00
Larynx	1.76	2.90	0.46	1.16	0.24	3.68	0.67	4.20	0.51	2.41	0.50	1.02	0.13
Lung, trachea & bronchus	4.23	6.50	1.63	8.60	3.27	7.62	2.62	8.39	1.33	5.26	1.12	1.48	0.73
Other thoracic organs	0.27	0.34	0.19	0.14	0.17	0.79	0.47	0.18	0.13	0.40	0.12	0.05	0.15
Bone	0.81	0.98	0.63	2.35	1.48	1.13	0.59	0.65	0.55	0.91	0.48	0.64	0.52
Melanoma of skin	0.54	0.60	0.46	0.30	0.19	1.27	0.69	0.58	0.49	0.29	0.26	0.31	0.69
Other skin	9.39	10.46	7.87	14.23	9.46	13.27	12.29	9.05	6.75	10.01	6.55	7.68	5.92
Mesothelioma	0.04	0.04	0.04	0.00	0.00	0.00	0.04	0.04	0.03	0.09	0.05	0.03	0.05
Kaposi sarcoma	0.10	0.15	0.05	0.18	0.00	0.08	0.00	0.13	0.00	0.25	0.14	0.09	0.04
Connective and soft tissue	0.61	0.66	0.54	0.48	0.34	0.76	0.76	1.02	0.59	0.54	0.64	0.09	0.06
Breast	7.21	1.05	13.30	0.75	8.43	0.57	16.61	1.28	14.01	1.36	13.02	0.86	10.96
Vulva			0.12		0.14		0.17		0.11		0.03		0.19
Vagina			0.27		0.25		0.11		0.18		0.29		0.62
Cervix uteri			2.25		0.93		3.02		2.33		1.84		2.76
Corpus uteri			1.04		0.40		0.75		0.87		1.68		0.99
Uterus unspecified			1.05		3.83		0.60		0.81		0.76		1.02
Ovary			1.99		1.65		2.04		1.71		2.28		2.12
Other female genitalia			0.13		0.00		0.33		0.03		0.12		0.18
Placenta			0.01		0.05		0.00		0.00		0.00		0.05
Penis		0.07		0.15		0.09		0.05		0.02		0.10	
Prostate		5.62		5.14		3.64		5.00		8.65		5.36	
Testis		0.95		0.72		0.77		0.91		1.41		0.57	
Other male genitalia		0.01		0.00		0.00		0.02		0.00		0.00	
Kidney	1.00	1.25	0.71	2.41	0.00	0.95	0.55	0.83	0.70	1.64	1.07	1.01	0.59
Renal pelvis	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
Ureter	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Bladder	4.72	7.50	1.55	8.58	2.46	7.48	1.83	6.39	1.20	9.33	1.59	5.34	1.37
Other urinary organs	0.02	0.02	0.02	0.00	0.08	0.06	0.00	0.02	0.00	0.00	0.05	0.00	0.00
Eye	0.16	0.10	0.22	0.03	0.34	0.31	0.52	0.06	0.18	0.04	0.12	0.00	0.00
Brain, nervous system	1.97	2.18	1.73	4.17	3.09	2.64	2.02	2.88	1.83	1.08	1.47	0.95	0.79
Thyroid	1.32	0.69	1.93	0.65	1.27	0.84	2.49	0.55	1.21	0.83	2.82	0.46	1.35
Adrenal gland	0.01	0.01	0.02	0.00	0.00	0.02	0.04	0.00	0.01	0.00	0.02	0.00	0.00
Other endocrine	0.07	0.09	0.06	0.28	0.08	0.05	0.08	0.15	0.10	0.06	0.03	0.00	0.00
Hodgkin disease	0.94	1.21	0.65	0.47	0.46	1.88	0.81	1.46	0.75	0.88	0.53	0.71	0.56
Non-Hodgkin lymphoma	2.58	3.44	1.65	2.81	0.69	5.90	2.72	3.32	2.03	2.52	0.92	2.27	1.30
Immunoproliferative	0.01	0.01	0.01	0.00	0.00	0.05	0.04	0.00	0.00	0.00	0.00	0.00	0.00
Multiple myeloma	0.88	1.16	0.56	0.25	0.13	1.80	1.03	1.17	0.73	1.26	0.43	0.62	0.06
Lymphoid leukemia	0.57	0.73	0.39	0.46	0.37	1.68	1.01	0.75	0.31	0.41	0.20	0.16	0.12
Myeloid leukemia	0.31	0.33	0.29	0.29	0.24	0.76	0.60	0.31	0.41	0.14	0.09	0.13	0.02
Leukemia unspecified	2.03	2.24	1.75	0.79	0.96	3.07	2.62	2.87	2.00	2.17	1.49	1.14	1.12
Other and unspecified	3.89	4.54	3.24	6.80	6.86	4.04	3.37	3.99	2.82	5.05	2.85	2.78	2.42
All sites	92.32	103.83	76.76	149.71	107.72	90.48	79.93	105.01	74.39	106.32	72.13	84.90	69.05
All sites excluding skin	82.93	93.38	68.88	135.50	98.26	77.22	67.69	95.95	67.63	96.31	65.57	77.22	63.11

Time trend

Appendix Table 26. Age-standardized rate (ASR) by cancer site, year and sex in four provinces (corrected for cases of unknown age and under-registration in elderly ages)

Site	ASR by Year and Sex in 4 Provinces (Gilan, Mazandaran, Golestan and Kerman)									
	1996		1997		1998		1999		2000	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Lip	0.57	0.57	0.62	0.18	0.37	0.27	0.46	0.35	1.10	0.40
Tongue	0.23	0.44	0.10	0.15	0.08	0.16	0.23	0.33	0.18	0.53
Mouth	0.06	0.30	0.35	0.29	0.25	0.48	0.16	0.20	0.55	0.51
Salivary glands	0.30	0.07	0.14	0.14	0.18	0.05	0.20	0.34	0.13	0.20
Tonsil	0.11	0.00	0.06	0.04	0.07	0.00	0.04	0.04	0.00	0.00
Other oropharynx	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nasopharynx	0.34	0.06	0.30	0.00	0.48	0.30	0.59	0.24	0.46	0.39
Hypopharynx	0.06	0.09	0.08	0.10	0.20	0.16	0.14	0.32	0.15	0.12
Pharynx unspecified	0.13	0.13	0.29	0.08	0.14	0.17	0.17	0.13	0.11	0.09
Esophagus	7.71	5.93	8.15	6.17	7.56	5.22	8.56	6.24	9.60	6.62
Stomach	12.70	3.56	12.90	5.39	13.71	5.42	14.23	6.11	16.44	6.66
Small intestine	0.34	0.16	0.50	0.20	0.35	0.10	0.47	0.28	0.36	0.29
Colon	1.98	1.87	2.15	2.54	2.19	2.99	3.10	4.41	3.82	4.22
Rectum	1.23	1.21	1.57	1.43	1.60	1.86	2.73	1.61	2.34	1.98
Anus	0.11	0.05	0.16	0.14	0.38	0.04	0.05	0.11	0.00	0.08
Liver	0.91	0.42	0.91	0.25	1.36	0.77	1.18	0.67	1.00	0.86
Gallbladder	0.45	0.80	0.40	1.04	0.34	0.94	0.50	1.18	0.58	0.71
Pancreas	0.55	0.35	1.54	0.68	1.04	0.47	1.18	0.76	1.37	0.95
Nose, sinuses	0.07	0.00	0.04	0.05	0.24	0.12	0.15	0.04	0.01	0.07
Larynx	2.46	0.30	1.28	0.27	2.05	0.38	2.52	0.41	2.51	0.40
Lung, trachea & bronchus	2.73	0.73	4.67	1.65	4.90	1.02	4.24	1.18	6.61	1.56
Other thoracic organs	0.09	0.05	0.15	0.22	0.19	0.22	0.31	0.25	0.78	0.09
Bone	0.62	0.64	0.43	0.30	0.68	0.22	0.85	0.40	0.78	0.66
Melanoma of skin	0.42	0.28	0.67	0.20	0.41	0.58	0.49	0.47	0.34	0.52
Other skin	5.45	4.38	5.78	4.54	7.93	5.14	8.36	6.85	8.78	6.97
Mesothelioma	0.02	0.05	0.00	0.05	0.05	0.02	0.00	0.00	0.00	0.11
Kaposi sarcoma	0.04	0.00	0.12	0.00	0.07	0.08	0.19	0.07	0.10	0.07
Connective and soft tissue	0.73	0.34	0.27	0.32	0.18	0.87	0.53	0.12	0.57	0.55
Breast	0.44	8.54	0.49	7.75	0.94	9.47	0.66	13.31	0.37	13.92
Vulva		0.00		0.03		0.08		0.20		0.04
Vagina		0.21		0.18		0.16		0.32		0.32
Cervix uteri		1.29		1.19		1.42		2.55		2.12
Corpus uteri		0.69		0.60		0.67		0.94		0.76
Uterus unspecified		0.37		0.21		0.62		0.82		0.99
Ovary		1.14		1.05		1.32		2.43		1.80
Other female genitalia		0.18		0.12		0.08		0.07		0.10
Placenta		0.00		0.00		0.00		0.00		0.04
Penis	0.03		0.07		0.00		0.11		0.00	
Prostate	3.76		4.66		5.46		4.48		4.48	
Testis	0.52		0.30		0.54		1.04		0.89	
Other male genitalia	0.00		0.00		0.00		0.00		0.04	
Kidney	0.51	0.37	0.66	0.50	1.24	0.68	1.36	0.82	1.05	0.78
Renal pelvis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Ureter	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00
Bladder	4.38	0.82	4.41	0.92	6.66	1.51	6.21	1.30	7.58	1.45
Other urinary organs	0.00	0.00	0.04	0.00	0.04	0.00	0.00	0.00	0.00	0.00
Eye	0.07	0.07	0.03	0.15	0.16	0.18	0.16	0.31	0.05	0.14
Brain, nervous system	1.44	1.60	1.29	0.90	1.31	1.36	1.90	1.54	1.50	1.02
Thyroid	0.53	1.50	0.44	1.63	0.74	1.79	0.27	1.78	0.66	1.13
Adrenal gland	0.00	0.00	0.00	0.07	0.03	0.02	0.00	0.00	0.00	0.00
Other endocrine	0.18	0.08	0.07	0.00	0.02	0.10	0.02	0.08	0.02	0.02
Hodgkin disease	0.93	0.48	0.94	0.20	1.11	0.45	1.15	0.69	1.10	0.86
Non-Hodgkin lymphoma	2.28	1.19	1.95	0.86	2.51	1.23	3.58	1.88	3.38	1.69
Immunoproliferative	0.05	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00
Multiple myeloma	0.60	0.16	0.96	0.50	1.35	0.40	0.95	0.74	1.52	0.77
Lymphoid leukemia	0.53	0.16	1.13	0.29	0.51	0.61	0.73	0.46	0.44	0.34
Myeloid leukemia	0.28	0.18	0.29	0.31	0.28	0.40	0.41	0.25	0.30	0.17
Leukemia unspecified	1.43	1.23	2.16	1.28	1.93	1.92	2.39	1.62	2.74	1.87
Other and unspecified	2.73	2.03	2.23	2.05	3.56	2.15	3.30	2.37	4.23	2.78
All sites	61.02	45.12	65.51	47.04	75.32	54.67	80.26	67.62	89.10	68.66
All sites excluding skin	55.57	40.73	59.73	42.50	67.38	49.54	71.90	60.77	80.31	61.68

Method of calculating adjusted relative age-standardized rate

Appendix Table 27. Calculation of relative age-standardized ratio (RASR) and adjusted relative age-standardized rate (ARASR) from age-standardized rate (ASR)

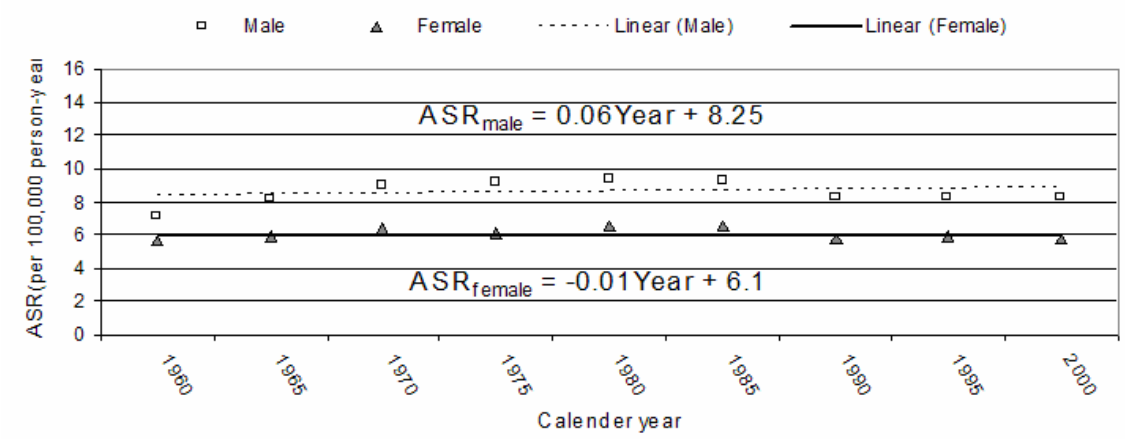
Cancer Site	Age-standardized rate (ASR_{Ci_y})*				
C_i	ASR_{Ci_1}	ASR_{Ci_2}	ASR_{Ci_3}	…	ASR_{Ci_k}
C_1	ASR_{C1_1}	ASR_{C1_2}	ASR_{C1_3}	…	ASR_{C1_k}
C_2	ASR_{C2_1}	ASR_{C2_2}	ASR_{C2_3}	…	ASR_{C2_k}
C_3	ASR_{C3_1}	ASR_{C3_2}	ASR_{C3_3}	…	ASR_{C3_k}
…	…	…	…	…	…
C_n	ASR_{Cn_1}	ASR_{Cn_2}	ASR_{Cn_3}	…	ASR_{Cn_k}
Leukemia	$ASR_{Leukemia\_1}$	$ASR_{Leukemia\_2}$	$ASR_{Leukemia\_3}$	…	$ASR_{Leukemia\_k}$

	Relative age-standardized ratio ($RASR_{Ci\_y} = ASR_{Ci\_y} / ASR_{Leukemia\_y}$)				
C_i	$RASR_{Ci\_1}$	$RASR_{Ci\_2}$	$RASR_{Ci\_3}$	…	$RASR_{Ci\_k}$
C_1	$RASR_{C1\_1} = ASR_{C1\_1}/ASR_{Leukemia\_1}$	$RASR_{C1\_2} = ASR_{C1\_2}/ASR_{Leukemia\_2}$	$RASR_{C1\_3}$	…	$RASR_{C1\_k}$
C_2	$RASR_{C2\_1} = ASR_{C2\_1}/ASR_{Leukemia\_1}$	$RASR_{C2\_2}$	$RASR_{C2\_3}$	…	$RASR_{C2\_k}$
C_3	$RASR_{C3\_1}$	$RASR_{C3\_2}$	$RASR_{C3\_3}$	…	$RASR_{C3\_k}$
…	…	…	…	…	…
C_n	$RASR_{Cn\_1}$	$RASR_{Cn\_2}$	$RASR_{Cn\_3}$	…	$RASR_{Cn\_k}$

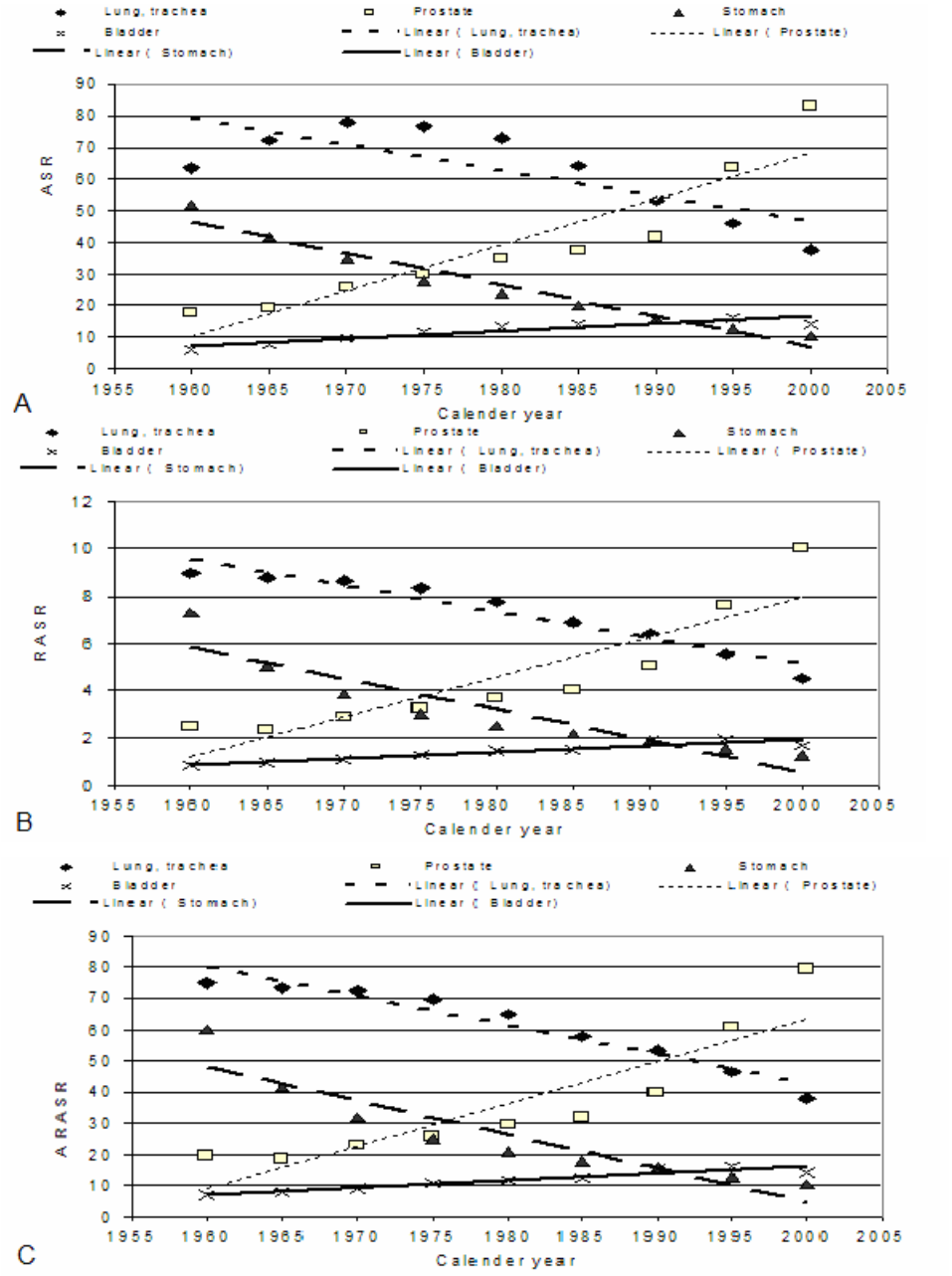
	Adjusted relative age-standardized rate ($ARASR_{Ci\_y} = RASR_{Ci\_y} \times Sum(ASR_{Ci\_1}, ASR_{Ci\_2}, \ldots, ASR_{Ci\_k}) / Sum(RASR_{Ci\_1}, RASR_{Ci\_2},\ldots,RASR_{Ci\_k})$				
C_i	$ARASR_{Ci\_1}$	$ARASR_{Ci\_2}$	$ARASR_{Ci\_3}$	…	$ARASR_{Ci\_k}$
C_1	$ARASR_{C1\_1} = RASR_{C1\_1} \times \sum ASR_{C1\_1,\ldots,C1\_k} / \sum RASR_{C1\_1\ldots C1\_k}$	$ARASR_{C1\_2} = RASR_{C1\_2} \times \sum ASR_{C1\_1\ldots C1\_k} / \sum RASR_{C1\_2\ldots C1\_k}$	$ARASR_{C1\_3}$	…	$ARASR_{C1\_k}$
C_2	$ARASR_{C2\_1} = RASR_{C2\_1} \times \sum ASR_{C2\_1\ldots C2\_k} / \sum RASR_{C2\_\ldots C2\_k}$	$ARASR_{C2\_2}$	$ARASR_{C2\_3}$	…	$ARASR_{C2\_k}$
C_3	$ARASR_{C3\_1}$	$ARASR_{C3\_2}$	$ARASR_{C3\_3}$	…	$ARASR_{C3\_k}$
…	…	…	…	…	…
C_n	$ARASR_{Cn\_1}$	$ARASR_{Cn\_2}$	$ARASR_{Cn\_3}$	…	$ARASR_{Cn\_k}$

* ***"C_i"*** is the cancer site (C_1 to C_n; for example C_{16} is Stomach) and ***"y"*** is the calendar year (1 to k).

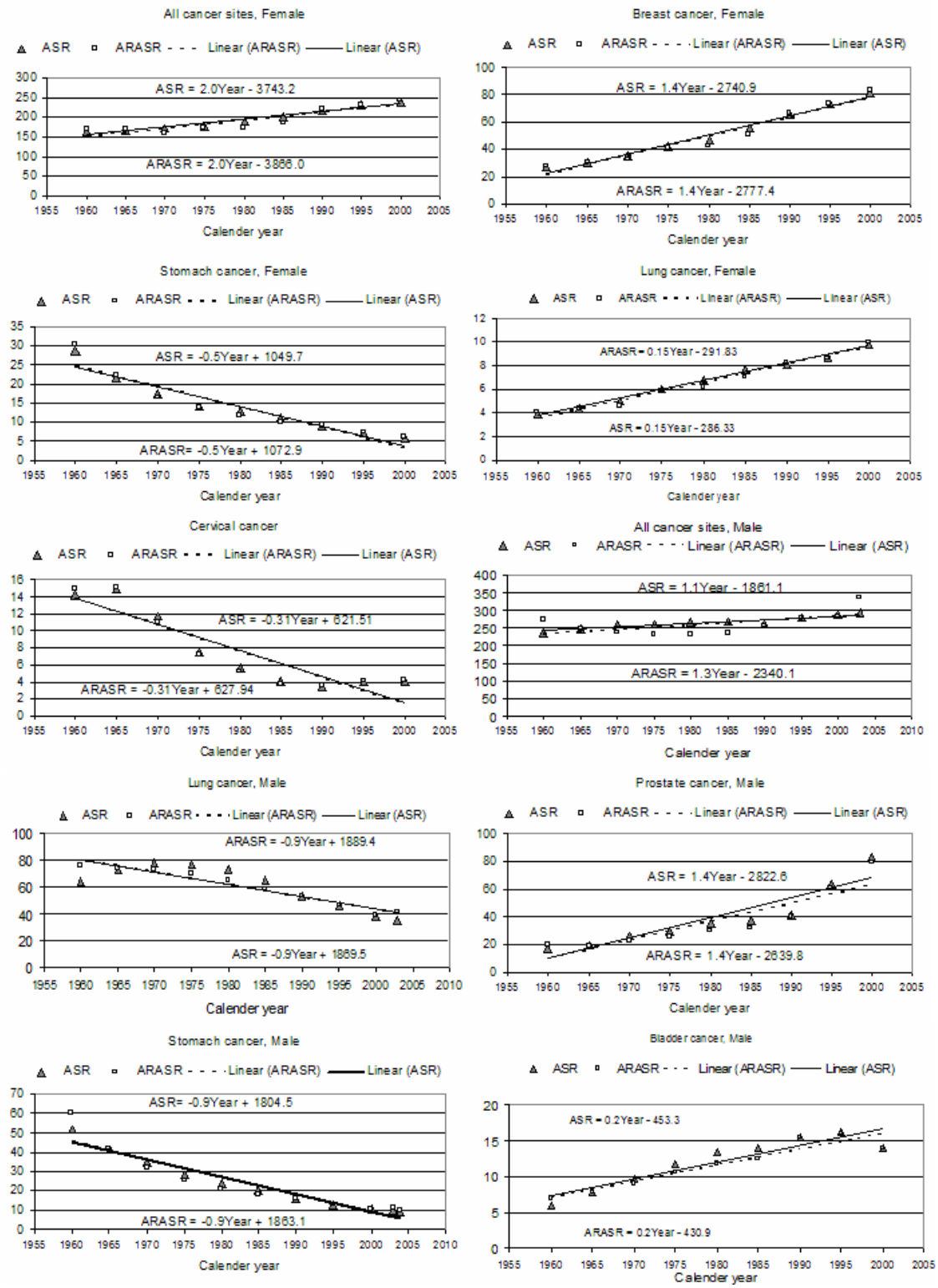
Time trend in Finland



Appendix Figure 6. Time trend of age-standardized rate (ASR) of leukemia in Finns

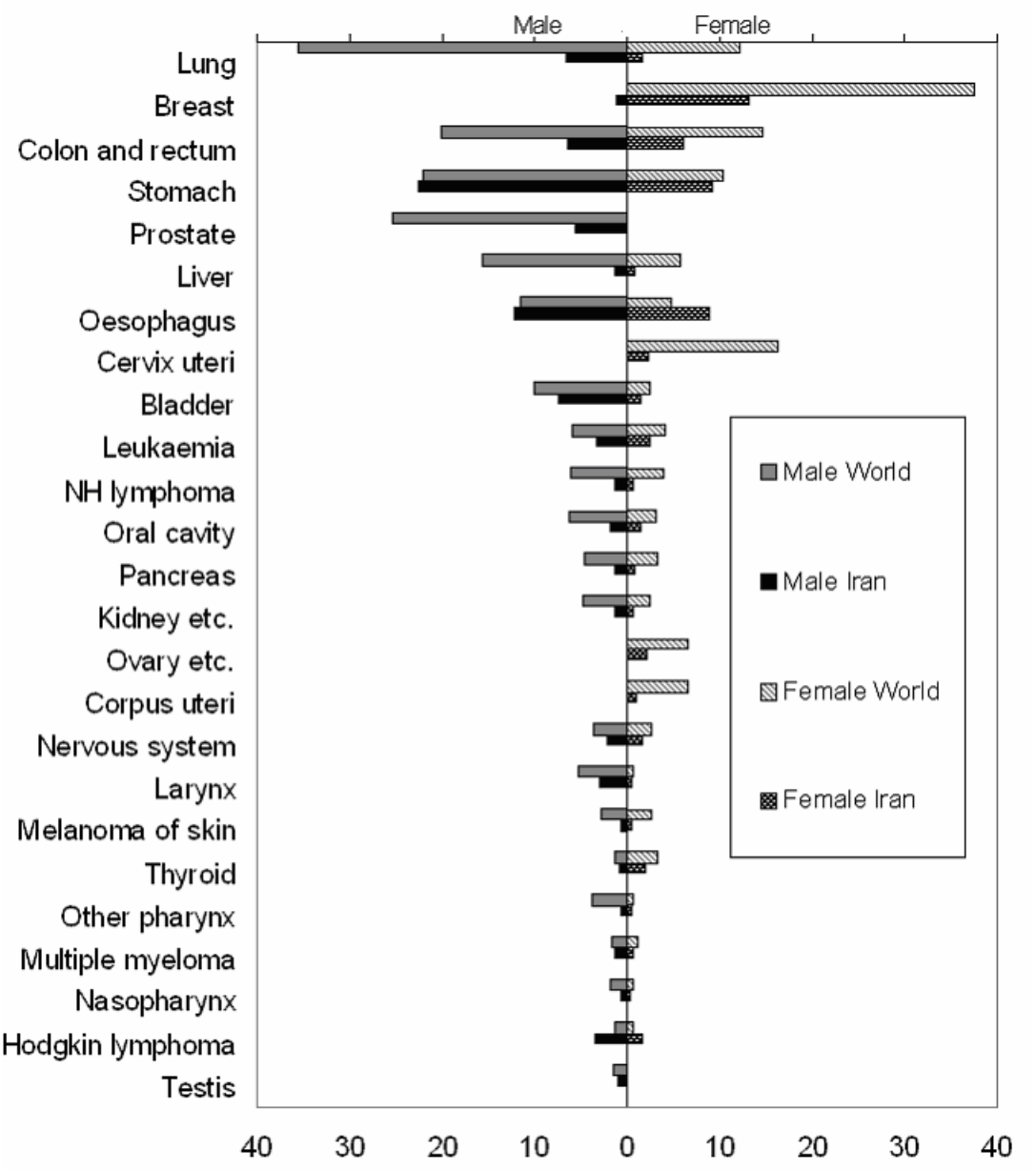


Appendix Figure 7. Age-standardized rate (ASR), relative age-standardized ratio (RASR) and adjusted relative age-standardized rate (ARASR) of four leading cancers in Finnish men



Appendix Figure 8. Time trend of age-standardized rate (ASR) and adjusted relative age-standardized rate (ARASR) of cancer, Finland and fitted linear regression line

Comparison between Iran and the rest of the world



Appendix Figure 9. Comparison between age-standardized rate (/100,000 person-years) of cancers in Iran and World